SCIENTIFIC AMERICAN

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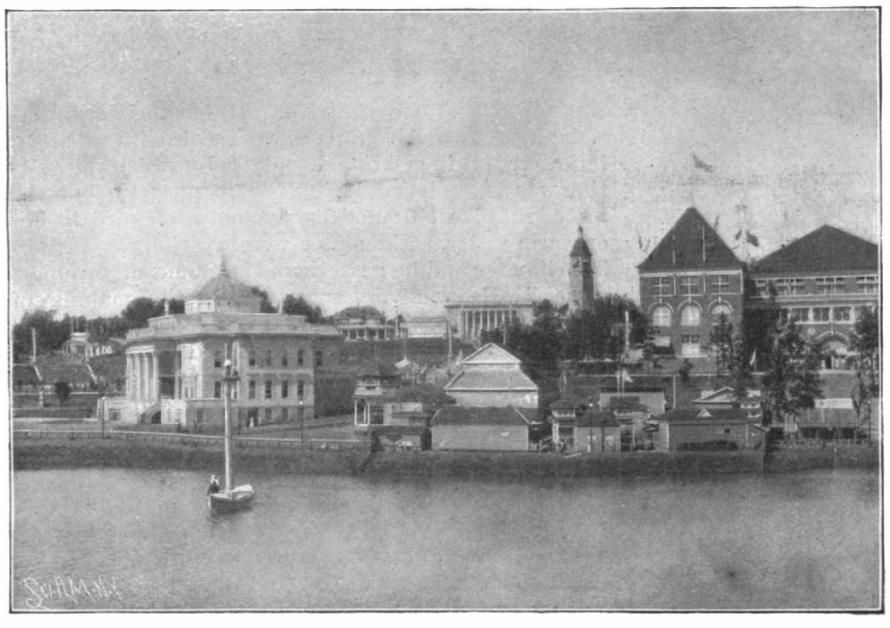
THE ATLANTA EXPOSITION.

At a meeting of the directors of the Exposition on November 7, it was announced that cash subscriptions had been made sufficient to cancel the accumulated indebtedness, putting the enterprise on a firm financial footing, with gate receipts increasing largely every day. The attendance has thus far been satisfactory, and the railroads centering in Atlanta are now running trains in double sections, which, it is expected, will bring a large increase of visitors. Chicago day and Manhattan day are being looked forward to as of exceptional importance in the matter of display and attendance. it being predicted that as many as 15,000 delegates from Chicago will be at Atlanta on the day set apart especially in honor of Chicago.

In the accompanying views we illustrate some of the notable features of the Exposition, the view across Clara Meer showing a model Japanese village, exhibiting the typical characteristics of this people.

There is an apparent lightness or breeziness in

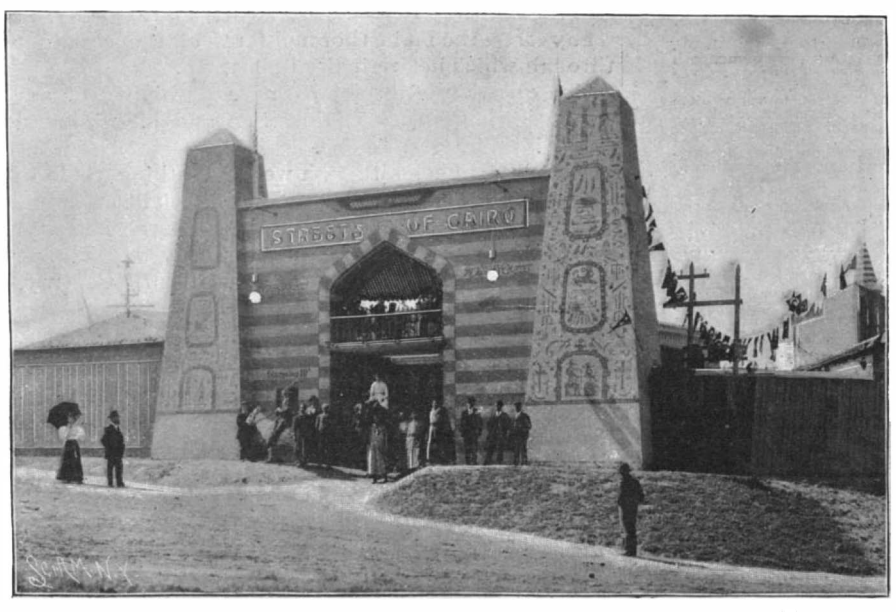


VIEW ACROSS CLARA MEER.

THE GOVERNMENT BUILDING.

THE FORESTRY BUILDING.

THE PHŒNIX WHEEL.



IN THE STREETS OF CAIRO.

TERRACE AND CLOCK TOWER WITH CHIMES.

THE ATLANTA EXPOSITION.

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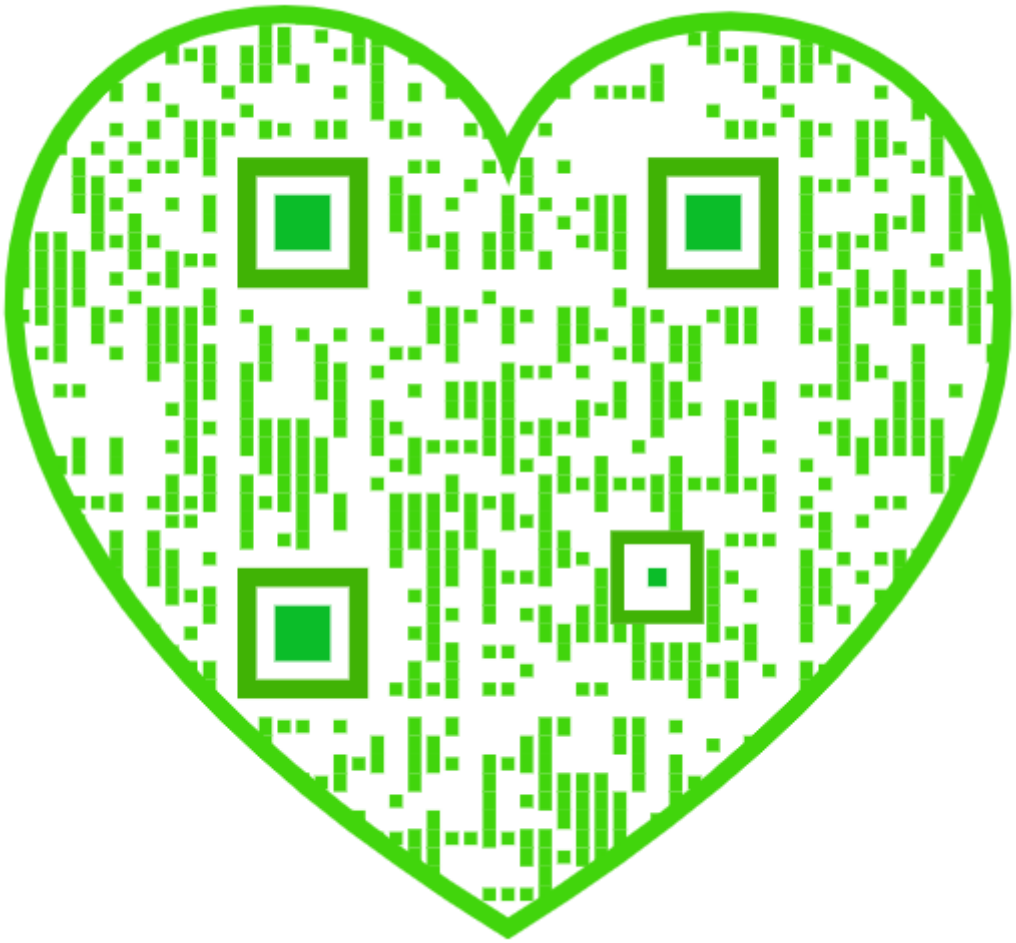

Japanese structure that precludes its general use in our severe climate, although it has a pictorial aspect that is pleasing in its variety. The large building overtopping the Japanese village is the Liberal Arts building, the Chime tower, Art building and New York State building being upon the terraced heights, while the large white edifice presents the Woman's building from one of the many standpoints that reveal its beautiful proportions. The pole and boat in the lake are part of the paraphernalia of the Life Saving Service exhibit, the upright mast representing the supposed mast of a stranded vessel. One of the crew is daily rescued from this mast in a genuine exhibit of the means employed in this service. A line is shot over the yard, the breeches buoy is sent out from the shore, and finally the exhibitor simulating a distressed mariner is brought safely to the shore.

The Government building is the most attractive and complete of all on the grounds, and in it are exhibits from nearly every department of the government—war, navy, interior, treasury, etc. About one-sixth of the floor space is given to army siege and field guns, army rifles, military trappings, wagon trains, models of men and horses fully accoutered for service, etc. In a similar space for the navy are shown models of ancient and modern United States war vessels of large size in glass cases, including a full sized torpedo boat ready for service and the various forms of guns and small arms used in the service. The Smithsonian Institution contributes a varied and educational display. The Lighthouse Board, Fisheries Commission and Signal Service have many beautiful and interesting features, and in the southwestern corner of the building are tanks for living fishes of many species.

The L of the corner is utilized with a broad passageway so arranged that the only light coming into it passes through the water in the tanks, thus giving perfect illumination of the fish. One side of the L is devoted to salt water and the inhabitants thereof, while the fresh water fish are in the tanks on the opposite side. This portion of the building is always crowded with visitors, and great credit is due the commission for the taste displayed in its arrangement. The portion devoted to the Agricultural and Treasury departments is also exceedingly interesting. Every variety of government note, bond, postage stamp, vignettes, portraits, etc., is shown, and a stamp is in operation producing medals and coin.

The Forestry building, with a floor space of 3,000 square feet, is unique in construction, in that the timber on its exterior surface and the interior supporting timbers are not denuded of their bark, thereby giving to this building the appearance of being a colossal rustic summer house. In the exhibits forming its attractive interior are shown all the varieties of Southern wood, both in the rough and finished state. The western half of this building (in the immediate foreground) is devoted to minerals, and here are shown all the useful Southern minerals, as coal, marble, limestones, granite, clays, etc., and many of the more valued stones for jewels and ornamentation. An octagonal turret rising from the center breaks up the straight lines of the side walls. Projecting porches on the ends and sides also materially assist in destroying a monotonous flatness to the elevation.

The Phœnix wheel, whose larger prototype proved so attractive at Chicago, is also a good drawing card for visitors at Atlanta. The wheel is rotated by a huge sprocket chain engaging with the sprockets upon one of the circular rims, the chain being driven by a steam motor. Upon either side of the street where the wheel is located are buildings devoted to amusement exclusively.

In the "Streets of Cairo," the architecture of Egypt is represented both in form and decoration. The locality is devoted to booths, where are sold trinkets and souvenirs, supposed to come from Egypt, the dealers being dressed as Egyptian natives.

Looking toward the Government building from the plaza, the most prominent feature, as represented in one of our views, is the "Chime" tower, as it is called. It is located upon one of the terraces that surround the grounds of the Exposition, and contains a chime of thirteen bells and a tower clock. Back of this tower is shown the Government building, and upon the left is seen a portion of the Art building.

A Scientific Prize Awarded.

Mr. J. R Roosevelt, secretary to the United States Embassy, has presented to Lord Rayleigh and Prof. Ramsay the check of the embassy for $10,000, being the Hodgkin prize awarded by the Smithsonian Institution of Washington for their discovery of new properties in the atmosphere. The recipients of the prize have written a letter of thanks to the Smithsonian Institution.

This, we believe, is the largest prize ever awarded in this country for a scientific discovery. The founder of the Smithsonian Institution was an Englishman, and that his own countrymen should have won the reward is a matter of especial gratification.

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THOMAS C. ROCHE.

Another practical worker in photography has passed away. We refer, with regret, to the death of Thomas C. Roche, on October 22 last, 68 years old, following just a year after the decease of Charles Ehrmann.

Mr. Roche, we are informed, began the practice of photography in 1858 as an amateur photographer, practically when the wet plate process began to be extensively used.

In 1860 he brought into use aniline dyes for photographic purposes, for tinting albumen paper and the coloring of photographic prints. In 1862 he was induced to become a professional photographer and became associated with E. & H. T. Anthony & Company of this city, one of the oldest photographic manufacturers, whom he served for the past thirty-three years as their expert in photographic matters. At the time stereoscopic pictures were the fashion he did an immense amount of work, making stereo negatives of Central Park, and, under the protection of General Meigs, numerous pictures of battle grounds of the civil war.

In 1877 he was awarded a silver medal for the best carbon transparencies, and received a similar award the following year. About this time he suggested an important improvement in collotype printing which is now being used commercially. It is said in 1879 he produced the first specimen of gelatino-bromide paper made in the United States, for which he was afterward in 1881 awarded a patent. He also invented an improvement in gelatine dry plates by which the gelatine was so hardened during the manufacture of the plates that it would not dissolve out afterward in hot or warm water. The plates were specially useful in hot climates and he gave them the name of "tropical plates." He was very successful in the making of collodio-bromide emulsions and in preparing dry plates with the same, while later he learned to manipulate the gelatine dry plate perfectly. He was familiar with many different processes, was fond of experimenting in several directions and always willing to aid and help amateurs and others out of difficulties in photographic manipulation.

He was generally quick and alert in grasping the salient points of photographic problems and was considered a rapid operator. For several years he was an active member of the Operator Photographers' Association. One of his last demonstrations before a photographic society was on the primuline process before the Society of Amateur Photographers of this city. We learn that one of his sons is engaged by the New York Herald as chief of the photographic department in that newspaper office, a fitting continuation of the usefulness of the father. His loss will be greatly felt by many of the old and many of the new photographers and in a greater degree by the firm in whose service he has been so long.

THE PERMANENCE OF MODERN BUILDINGS AND PUBLIC WORKS.

If history is to repeat itself in telling the story of the great civilized nations that dominate the world today, there is an age coming when the Anglo-Saxon race in both hemispheres will be known only by the monuments of its skill and labors that may happen to survive it.

The kingdoms of Assyria, of 4,000 years ago, speak to us from the sculptured walls of Nineveh.

Thebes, the Sphinx and the towering mass of the Pyramids are eloquent witnesses of the skill, resourcefulness, and undoubted wisdom of the ancient Egyptians.

The Parthenon, at Athens, and a thousand sculptured fragments strewn thickly over its classic soil, will preserve for ages to come the record of Grecian art.

The colonizing Roman has left enduring monuments of his taste and skill, both as architect and engineer, and the highways that he constructed are to-day, in many cases, the main thoroughfares of the countries through which he originally built them.

The question of the comparative durability of our Nineteenth Century engineering and architectural works is an interesting one.

We will assume—although we see nothing to indicate the fact—that the tide of Western civilization has reached its high water mark, and that in the splendid achievements in the arts and sciences, which have marked the closing years of the Nineteenth Century, the Western races have reached the zenith of their powers. We will assume for the sake of argument that from this time on a decline shall set in which shall ultimately lead to a decrepitude and decay as complete as that of the races of Assyria and Egypt, Greece and Rome—and at the same time ask the question: How many of our great public works will be left standing upon the earth forty centuries hence, to bear witness to our Nineteenth Century knowledge and skill?

Are there in New York, London or Paris buildings that will stand for forty centuries the buffeting of wind and weather as those stately edifices by the Euphrates and Nile have stood? Probably not; nor

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is the fact any reflection upon the work of the modern builder. It is merely a result of the more artistic modern taste, which expresses itself in a style of architecture that is at once more picturesque and less durable than the gloomy temples and palaces of the ancient builders.

This is the age of steel and iron, materials for construction of which the ancient races appear to have known very little. As compared with stone, they are less durable. Left to itself, an iron or steel structure will, in time, corrode and disappear. Unless the skeleton frames of our modern lofty buildings be carefully built in and protected from oxidation, it is certain that their life will be limited; for, should the steel work ever be eaten away by rust, there will be no strength in the lower walls adequate to carrying the great superimposed load of the upper stories. This, of course, is not an immediate contingency; but in reckoning the life of buildings—as we are now doing—by centuries, it is an element of decay that may ultimately be responsible for their collapse.

Of the great steel and iron structures, such as the Brooklyn and the Forth bridges, it may safely be said that their life will be contemporaneous with their careful maintenance and repair. The theory of the crystallization of steel under continued stress is now pretty well exploded; and it is generally conceded that if a steel structure, such as the Brooklyn bridge, which is subject only to static strains, be carefully protected by painting, its life may be indefinitely prolonged. Left to itself, however, as the works of the ancients have been left, the rust eating through the cables would ultimately bring the whole structure into the river, leaving the granite towers as an indestructible monument to mark where the bridge once stood.

The great systems of waterworks, both for municipal supply and for irrigation, will provide many lasting monuments to the energy and skill of the nineteenth century. Nothing constructed in Egypt or Assyria was more durable than is the masonry of the great dam of the Croton waterworks.

In constructing our vast system of railroads we have written our history in monumental lines of rock and earth, that will probably last as long as this globe turns upon its axis. Should some glacial period return and grind these embankments and cuttings out of existence, there would yet remain the great tunnels, to show with what unconquerable energy we pushed our way even through the heart of the hills themselves.

Autumnal Tints.

Now that the shortening days and lengthening nights are gradually inducing that wintry sleep of vegetation prior to which a large percentage of trees and shrubs and lesser growths throw off entirely their leafy garb, we find these unobtrusive green leaves rivaling the brightest blossoms of the summer in the brilliant tints they assume. Curiously enough, too, in most cases the alteration of the sap, as its vital flow is first slowly checked and then stopped altogether, leads to the assumption of a gamut of tints embracing the brightest complementary colors of the normal hue of green. In one and the same leaf we start with the pale green of the opening buds in spring, the ripe, dark viridity of the late summer, and now, at the first keen frost, it first turns pale and sallow, and then blushes vividly, changing into glowing scarlet as it falls fluttering to the ground. Here, in the succeeding stages of decay, the scarlet deepens and sobers down into warm russets and browns prior to merging into the dusky tints of Mother Earth herself. The subtile changes which lead to this wonderful display of color are extremely interesting when considered in relation to the laws of color generally. Every tint, as is well known, has its own particular number of vibrations of the rays of light which produce it, precisely as every tone in sound or music has its special number of aerial vibrations, which cannot be altered without altering the pitch. Hence, in the leaf, during its period of vitality, it is endowed with a capacity for absorbing all the tints but the green, which it rejects and reflects, and by virtue of which we term it of that color. So soon, however, as its vitality declines a change sets in, and as it wanes the light is gradually decomposed in a different degree, and correspondingly divers hues are reflected in the process. If we observe the colors of the rainbow or spectrum, we shall invariably find a certain order maintained; beginning with violet, the tints gradually merge into indigo, and thence into blue and green. Then, starting from this completed half, we find precisely the same successional order as we observe in decaying leaves, viz., the pale greens, yellows, orange, and reds, which render our autumnal landscapes so brilliant as to defy the palette of the painter to reproduce them. This richness of coloring is a feature which merits full recognition in the choice of trees and climbers especially. A wall covered with Ampelopsis Veitchi, for instance, is intensely beautiful for several weeks before the foliage actually drops, the varying degrees of exposure to sun or frost bringing out the colors irregularly, and thus adding the additional charm of contrast, since all the hues from green to scarlet will be presented in a single coup d'œil.—The Gardeners' Magazine.

Electric Road Carriages.

M. Rechniewski contributes to L'Electricien an account of the vehicle built by M. Jeanteaud, which ran the Paris-Bordeaux race without serious accident. He says that electricity propelled carriages are, nevertheless, yet only in their experimental stage. From the driver's point of view the electric carriage has the most convenient and manageable motor and leaves nothing to be desired on this count. Its most inconvenient feature is that it is necessary to seek a charging station after running a certain course for the purpose of being recharged or of a change of cells, an inconvenience less serious for certain services than for others, as, for instance, when a carriage runs between certain fixed points or stations. The first item to be considered is the distance that can be run on one charge; the second item is the possible running speed. Among the many accumulators tried up to date for road vehicles, those of the Fulmen type have given best results, and the arguments of the article are based on the figures obtained therewith. The batteries used on the Paris-Bordeaux route weighed complete 850 kg. (1,875 lb.), and had 38 elements of C 21 type divided into a dozen boxes of 3 or 4 elements each. Each element had 15 kg. of electrodes and a capacity of 300 ampere hours at the ordinary rate of discharge of 10 hours. At a discharge of 70 amperes, nearly 5 per kilogramme of plates, the capacity of the battery would be still 210 ampere hours. Unfortunately, the mean power at the 10 hours' duration of discharge is fixed a trifle low, and the length of the road between charging stations is thus very important. As the electrical carriage bears its own battery, and this is limited in its storing power, the question of weight and efficiency are of special importance, and it is desirable to reduce weight to a minimum.

The vehicle of M. Jeanteaud at present holds the record for speed and distance among its electrical competitors. It is a plain vehicle with no offensive pretense in the shape of a dummy animal in front; it has two parallel seats, each of two places, and a back to back seat at the rear and provided in front with a circular splash guard carrying a triple bullseye lamp. The accumulators are placed beneath the rear seats. The wheels are of hickory, 1 meter diameter in front and 1·40 meter behind, and they carry respectively 1,200 and 2,000 kilos., or a total of 3,200 kilos., or fully 3 tons.

The front end is supported by two bow springs set transversely one above the other and coupled back and back, so giving the effect of a central support to the body of the carriage and halving the effect of a stone or lump under either wheel, as well as giving a very elastic suspension and easy running. The body of the vehicle is entirely of steel. The axles have bearings of 45 and 55 millimeters at the front and rear; on the day of the race an accident bent the rear axle, which ran hot all the time and compelled stoppages continually for cooling and oiling, and when examined at the journey's end, the axle box was proved to have seized badly, and to this common accident the delay of the electrical carriage was entirely due. There is a brake on the wheel tires actuated by a pedal and another brake worked by wheels at each end of the seat for use in case the driving chain broke upon an incline, the two brakes giving absolute security in the working of the machine.

The mechanical arrangement consists of a shaft carrying differential gear driving the wheels by two chains, the gearing permitting speeds of 12 and 24 kilometers per hour at the ordinary speed of the motor—7½ and 15 miles.

The motor built by the Société Postel Vinay has given excellent results, both on a brake test and over the course of 600 kilometers (375 miles), which it ran without a failure, and so takes a position in advance of anything yet tried. Its efficiency was over 90 per cent when working at a voltage of 70, and nearly 7 horse power with 70 amperes. This is necessary for the traction at the rate of 24 kilometers. The weight of the motor is 225 kilos., and it develops 14 or 15 horse power when surmounting hills without heating or sparking, and it acts as a dynamo or brake in descending hills to the extent of 80 amperes. Though too little to be taken into account, it is enough to secure excellent regulation in descending hills. The intended output of 70 amperes has frequently been doubled, and even 200 have been drawn for an appreciable time without lowering of the voltage. In spite of such enormous outputs, of frequent journeys by rail of some of the batteries returned to Paris to recharge, and sent on again to Bordeaux, of hasty transshipment and frequent operations by unaccustomed hands, and of shaking on the road, these batteries have behaved well and kept their charge. Each battery of 850 kilos. served for a run of 40 to 70 kilometers, according to the nature and profile of the route. Ten minutes served to change them at the stations, and the reconnection is automatic by means of springs and metal plates.

It was only in March, three months before the race, that the construction of the carriage with its motor and battery was commenced, and only one trial was made prior to the race of June 6, and except for the heating of the one axle, no part of the vehicle or of its machinery called for the slightest repair during the run of 600 kilometers, as is proved by its return to the exhibition after the journey.

Messrs. Jeanteaud et Brault aimed less at the prize than at demonstrating that electricity has entered the practical stage in road traction, and we can only regret that the unfortunate accident to the axle should have prevented the vehicle from showing what would surely have been even a much better record. At the same time, the weight of over three tons should be kept in mind as something to be, if possible, reduced, as it is a great bar to the success of accumulator propelled carriages for general work.

A Fiberloid Explosion.

The city of Newburyport, Mass., was startled about 10 A. M., October 23, by the explosion of what are known as the Fiberloid Works, by which many were wounded and several lives were lost. The facts are as follows: Last May the Fiberloid Company started operations as successors to the Lithoid Company for the manufacture of collars and cuffs. Fiberloid, which is merely a trade name, is nearly identical with celluloid, being a hard elastic substance made by subjecting gun cotton or pyroxylin with camphor and other substances to a hydraulic pressure of 4,000 pounds to the square inch. This compound is very inflammable and highly explosive, and a former explosion took place in the same place, only with another company, June 14, 1890. Hence the utmost caution has been observed.

There are eleven buildings in all, employing a hundred hands. One object in having so many small buildings is to limit the results of accidents. The dry house is where the recent catastrophe took place. This is a room where the pyroxylin is dried after being washed to free it from acid. The lot on hand had been washed with especial care. The point of ignition is known to be about 385 deg. Fahr., and a man who was in the dry house four minutes before the explosion noted the temperature as being only 100 deg. Fahr. The man in charge was accustomed to use wooden scoops for shoveling the cotton; and he also wore tennis shoes with rubber soles so as to prevent friction from shoe nails. In short, every known precaution was taken; and yet there was this explosion that killed McManus, the man in charge of the dry room.

William Giles, foreman, had just left the dry room before the explosion occurred, and thus escaped uninjured. He testifies that the temperature had been noticed by him as being only 100 deg. Fahr., whereas the cotton does not ignite below 385 deg.

William H. Poor was in the mixing room; was badly burned, but is expected to recover. His statement is that the explosion in the dry room burst a hole through the wall into the mixing room, where it ignited the nitrated cotton and the alcohol. He thinks McManus was dragging a paper barrel of cotton across the floor and that the friction ignited the cotton dust scattered on the floor. The shock from the explosion was felt all over the city of Newburyport, breaking many windows, throwing down objects from shelves and doing other damage.

Gambier.

The following paragraph is a part of a speech delivered by the Marquis of Ripon, K.G., late secretary of state for the colonies of Great Britain, at the anniversary dinner of the Linnean Society. It is a good thing to be honest enough to acknowledge ignorance, but how a secretary of state for the colonies could have escaped hearing something of gambier is a mystery.

"I had a curious proof the other day of the way in which plants of great value may be but little known to those who do not cultivate science, or are not engaged in those industries in which these plants are employed. I received a deputation from Leeds. Though most of you probably think only of Leeds as an important place for the production of cloth, yet there is a great leather trade in Leeds besides, and this deputation of leading men came to me to do what I could to help to increase the production of gambier. They told me they could not get on without it; that it was absolutely essential to their industry, and that it came shipped to them from Singapore. I believe the largest quantity is not grown in Singapore, but comes from the native states beyond. I am bound to say that until I had received this deputation, I had never heard of gambier. I knew nothing about it."

The interest of this paragraph lies not in the ignorance of the official, but in the information it gives of the growing scarcity of gambier. If that deputation of citizens of Leeds should turn to the United States, they would learn that we have a substance here called canaigre, prepared from the roots of Rumex hymenosepalus, that will sooner or later displace gambier, which is of uncertain origin, uncertain quality and uncertain effect.

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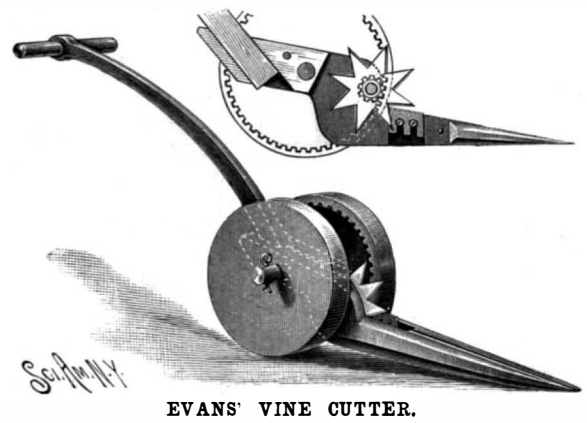
AN IMPROVED VINE CUTTER.

The illustration represents a machine adapted to cut off parts of any creeping vine or for trimming or cutting off runners, and it may be carried close to the plant to cut off desired portions without injuring what is left, the cutters being also readily adjustable and easily accessible for sharpening or cleaning. The improvement has been patented by Hammond J. Evans, of Hampton, New Brunswick, Canada. At the forward end of the machine is a sickle bar finger adapted to travel on the ground, and the body and finger bar are made in two sections divided longitudinally, there being in the rear portion of the finger bar and forward portion of the body a longitudinal opening where the cutters are located, as shown in the sectional view. The ground wheel at the left hand side of the machine

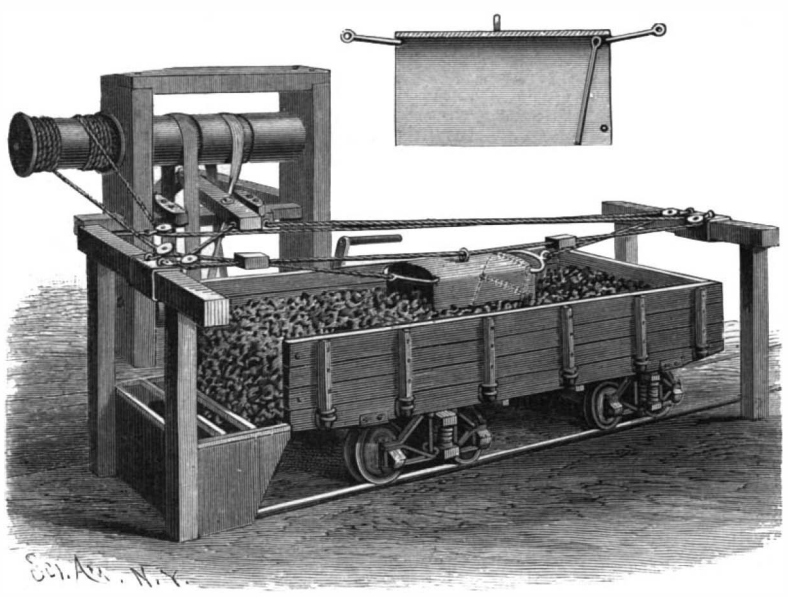


EVANS' VINE CUTTER.

has an internal gear and is fast on the axle, the opposing wheel being removable, while meshing with the internal gear is a pinion on a shaft carrying a stellated cutter wheel, whose teeth are sharpened on a bevel to meet the cutting edge of a cutter adjustably secured in the left hand wall of the longitudinal opening, the upper edge of the cutter being flush with the upper surface of the finger bar of the machine. The stationary cutter may be adjusted or removed as desired, and in case the vines might be damaged by the passage of the machine in its ordinary shape, the removable wheel may be taken off, bringing the cutters near the trunk and precluding the possibility of injuring the standing portion of the vine.

AN APPARATUS FOR UNLOADING CARS.

The illustration represents an apparatus designed to facilitate the unloading of coal, grain or other material from cars, scraping the load into a chute whence it may be conveyed to the desired point. The improvement has been patented by George T. Dixon, of South Butte, Montana, and communications relative thereto may also be addressed to Alexander Jamieson, Butte, Montana. In standards adjacent to the track is journaled a shaft carrying three pulleys and a projecting drum, a driving shaft operated by a hand crank being journaled lower down in the standards. Uprights have pivoted horizontal arms extending over the track near by, and on each of the arms is a sliding sleeve carrying two pulleys. A shifting lever is connected with two shifting arms under the three pulleys, and a straight belt is carried down from one of the end pulleys to the driving shaft, while the other end pulley is connected with the driving shaft by a crossed belt, in such way that the shifting lever will take either of these belts to an engagement with the center pulley, which is fixed on the shaft, the end pulleys rotating loosely thereon. The shaft may thus be driven in opposite directions by the shifting of the belts. A cable from the front end of the shifting lever is passed over one of the pulleys on one of the horizontal arms over the track, thence over the track and around a pulley on the horizontal arm at the other end of the car, and back to engagement with the shifting lever, there being two blocks or checks on the straight stretch of the cable over the track. Another cable is wound around the drum, extending thence over a pulley on one of the uprights and around a pulley on one of the horizontal arms over the track, from which it extends to a connection with one end of the scraper, while attached to the other end of the scraper is another cable extending to and being wound around the drum in an opposite direction, the latter cable passing around a pulley on the opposite horizontal arm. The scraper is of metal, nearly U shaped in cross section, and at its rear end is pivoted a gate limited in its rearward movement by a pin as shown in the small view. The car to be unloaded having been placed in proper position beneath the scraper, and the power shaft set in motion, the scraper is alternately carried forward and rearward, through and over the material to be unloaded, the checks or blocks on the straight stretch of cable automatically moving the shifting lever to cause the drum to be rotated in one direction or the other to move the scraper backward and forward, and the scraper filling itself and drawing the material toward the open end of the car in each forward movement.



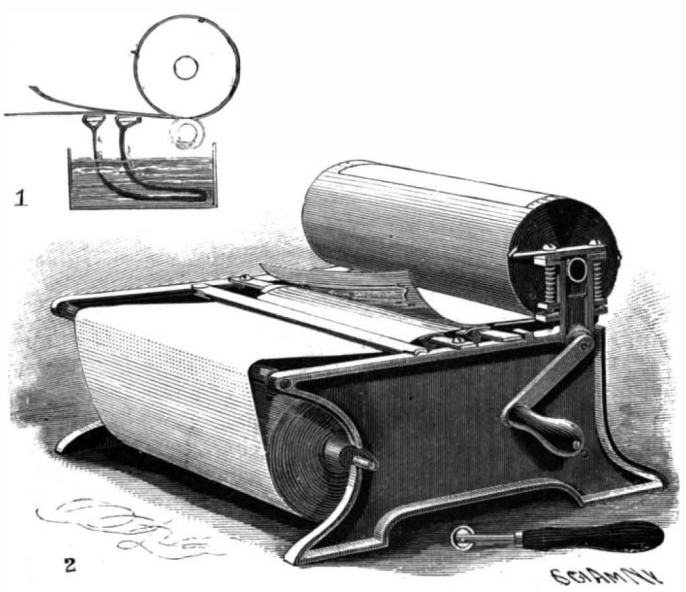
DIXON'S SCRAPER FOR UNLOADING CARS.

A Railway Through the Sea.

It is stated that Mr. Magnus Volk hopes to open his railway from Brighton to Rottingdean next Easter. The length is about four miles, and the lines are laid on the sea beach near to low water mark, so that they are submerged for the greater part of the twenty-four hours. There are four lines of rails, laid in two pairs, the width of gage between the outer rails being 18 feet. Each pair of rails is supported by concrete blocks mortised to the rock below, the steepest gradient being 1 in 300, and the sharpest curve half a mile radius. The car, which was designed by Mr. St. George Moore, of 17 Victoria Street, Westminster, who acts as engineer for the company jointly with Mr. Volk, is being built by the Gloucester Wagon Company. Each of the four main supports is a 12 inch steel tube, mounted on a four-wheel bogie. The leading bogies will be driven by vertical shafts inside the steel tubes. The deck of the car is 23 feet above the rails, and well out of reach of the waves. The deck will measure 46 feet by 22 feet, and will carry a saloon 25 feet by 13 feet. It was at first intended to drive by current obtained from accumulators, but the plan has since been altered to the trolley system. It is desired to erect poles on the shore to carry an overhead wire. The Crown has given its consent to their erection, and an application for a similar concession has been made to the Brighton Corporation, who own a short length of foreshore. The estimated cost was $125.000, and will not be much exceeded.

AN AUTOMATIC LETTER COPIER.

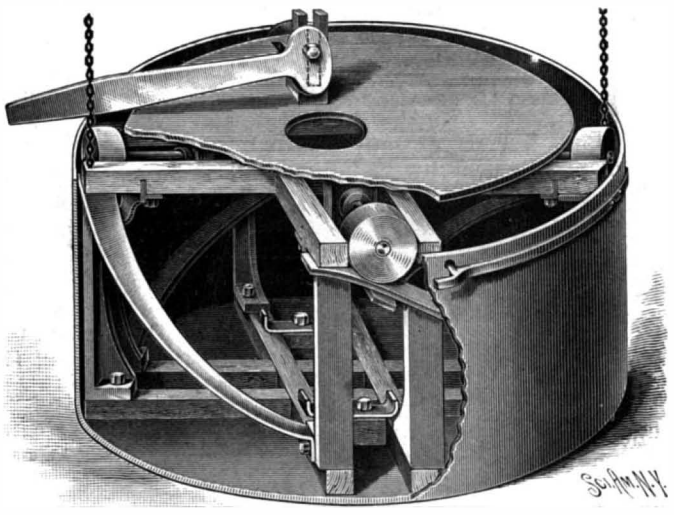
To copy letters on single sheets, enabling a copy to be attached to and filed away with the letter answered, the compact and simple machine shown in the illustration is brought out by the Anderson Copying Machine Company, of No. 41 Leonard Street, New York. The copying paper is carried on a roll, from which it is drawn forward beneath a spring-pressed copying cylinder by simply turning a crank, the paper, just before it reaches the copying cylinder, passing over moistened wicks on transverse rods. These wicks, as shown in the small sectional view, are formed of a piece of felt whose body portion lies in a pan of water beneath, and whose ends are lapped around the nickel plated transverse rods. A movable tension rod is used in front of the wicks, under which the paper passes, to hold the paper close to them, so it will pass evenly over the wicks and be thoroughly moistened. To copy a letter, the crank is turned until the indicator on the drum and the arm indicator are at the same point, when the letter is laid, written side down, on the paper, and the crank is turned until the letter and copying paper is passed around the cylinder, when both letter and copy may be released and taken off by running a rotary cutter through a shallow transverse slot in the cylinder. If desired, a number of letters may thus be copied on a continuous strip before cutting off, twenty letters requiring no more cutting than one. It is said that one hundred letters may thus be copied in five minutes, and the machine always gives a good copy, whether in the hands of a beginner or an expert.



ANDERSON'S AUTOMATIC LETTER COPIER.

A GALVANIZING AND TEMPERING TANK.

For dipping metal in a liquid bath, as required in setting and cooling tires, tempering steel, galvanizing articles, etc., the improvement shown in the illustration has been devised and patented by Charles A. Emanuelson, of Wilmington, Ill. It consists of a liquid-containing tank in which are inclined trackways, on which travel wheels supporting a platform carrying the articles to be immersed. In the bottom of the tank is a horizontal framework of mortised timbers, removably held in place by means of latches, and at the ends of the timbers are vertical brackets having at their upper ends inclined plates to which are secured the upper ends of the trackways, of which there are four, formed of sheet metal, inclined and curved downwardly in spiral form. The supporting platform for the articles to be dipped is formed of another similar horizontal framework, there being mounted adjacent to the end of each pair of timbers a shaft carrying rollers adapted to travel upon the tracks, while arms secured to the beams have bent fingers or tongues engaging the under sides of the trackways. The cover plate of the platform is of sheet metal, with a central circular opening and a slot at one side wherein is arranged an adjustable slide block and pivoted lever, to be manipulated by hand, and having a clamping surface to engage the article to be held on the platform. To hold the platform raised, there are on the outer sides of the tank springs having at their free ends fingers which extend through into engagement with the timbers of the platform frame, the withdrawal of the fingers releasing the platform to permit it to move to its lowermost position, the platform having at its opposite sides chains for raising and lowering it.



EMANUELSON'S GALVANIZING AND TEMPERING TANK.

For use as a galvanizing bath, the wooden timbers may be replaced by suitable metal braces and various other minor changes may be made to adapt the improvement to different uses.

Magnetism of Asbestos.

Faraday placed asbestos in the list of weak magnetic bodies, but recent observers have discovered that certain varieties of this mineral are strongly magnetic. Swinton, in the Electrical Review, has called attention to this property of asbestos, and Bleekrode shows that a gray variety exhibits strong magnetism even in comparatively weak magnetic fields. He points out that this substance should not be used as an insulating material in magnetic instruments.—Ann. der Physik und Chemie.

WHEN water freezes it expands with a force which Trautwine estimates at not less than 30,000 lb. to the square inch.

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A NOVEL CUTTING OFF MACHINE.

This is a band cut-off saw manufactured by Butterworth & Lowe, of Grand Rapids, Mich., who have improved on the construction and details, making the entire frame of iron and steel, and giving especial care to the counterbalancing and to reducing the friction to a minimum. The backbone of the machine, as well as the posts that carry the guide rollers, are of steel tubing; the yoke that carries the backbone is supported on trunnions that are cast solid with the base. The saw is maintained at a uniform tension by an adjustable coil spring, another sensitive adjustment controlling the position of the saw on the out end wheel. The guide rollers (between which the saw blade runs) can be adjusted to line the saw as desired, also to keep the saw teeth a proper distance from the edge of the rollers. Other adjustments also permit the use of saws two or even three feet shorter than commonly used on the machine. The frame is accurately balanced, and the use of a compensating sheave allows the saw and frame to be worked up or down at one point with the same force that is required at any other point. This force is very little, as the rope sheaves are fitted with roller bearings. The machine does not require a strong or special foundation, but can be bolted to the floor of the building. The log does not need dogging or holding while being cut. The machine can be operated entirely by hand, requires no friction or other mechanical hoists to raise the saw and has positive adjustments at all points.

For wood pulp work it is especially adapted, as the cut leaves the sawed ends smooth and clean, the saw teeth traveling in straight and parallel lines and in only one direction. In using the ordinary circular cut-off devices, or coarse tooth drag saws, small flakes of sawdust loosen in grinding and work into the pulp. The violent jarring of ordinary drag saws is obviated by the use of this machine, which works smoothly and rapidly. The machines are at present made to carry wheels 28, 36, and 48 inches diameter, the size of wheels limiting the machine to about that diameter of log.

A NOVEL CUTTING OFF MACHINE.

THE LAC INDUSTRY.

Lac, improperly called "gum lac," is produced in two very different ways: (1) through the puncture of various plants by certain insects (such as the lac of India, Persia and Madagascar), and (2) by an incision made in certain resinous trees (such as the lac of China and Japan).

Lac of India.—The Indian lac is collected from trees of very different genera—sacred fig, banyan, jujube, acacia, croton, etc. It forms under the influence of the sting of a hemipterous insect, the Carteria lacca or Coccus lacca. It is a gall insect of the cochineal kind, resembling a red louse, which, at the time of oviposition, fixes itself in great numbers upon the young branches of the above-named plants. These insects secrete a resinous and waxy substance which solidifies, in imprisoning the insects, and forms a thick crust that covers the epidermis of the branch attacked. The oviposition is effected during this transformation. The female dies, and her body becomes a vesicle filled with a reddish liquid designed as food for the larvæ. Each female lays twenty eggs, which become larvæ and perfect insects and escape from the resinous stratum.

The collecting of the lac is done by gathering the branches upon which it is found before the transformation of the larvæ into perfect insects. The lac is delivered to commerce in sticks, grains, scales and threads. "Stick lac" is the natural product. This lac still adheres to the branch upon which it was produced.

"Seed lac" is merely the preceding broken into fragments and separated from the branch. Sometimes it consists of pieces that have fallen from the branch and been carefully collected. "Shellac" results from the fusion of the first. It is prepared as follows: The stick lac is broken in order to free it from the impurities that it contains (fragments of bark, wood, etc.) It is then put into tubs of water, in which the Indians bray it with their feet in order to wash it well. The water is renewed until it finally comes off clear (Fig. 3). The washed lac is then boiled with alkaline water in order to dissolve the color that it contains. The softened and melted resin rises to the surface of the bath, while the color, called "lac dye," is collected by decantation and is used for dyeing morocco leather and cashmere wools. The lac in paste is put into a long and narrow cotton bag that two Indians hold by the ends and twist in exposing it to a quick fire burning in an open grate (Fig. 4). The lac passes through the fabric and falls into a wooden trough, from which it is ladled by an Indian and poured in the form of a thin stratum over copper cylinders. Before the lac is completely dry, it is broken into irregular scales that are submitted to a moderate pressure. These scales are very thin, transparent, brittle, and of a golden reflection. Lac in threads is merely lac drawn out while it is melted to a pasty consistence. In commerce there are distinguished brown, red and yellow lac. The difference between these is due merely to their degree of coloration by the alkaline liquor, as we have just said.

In order to obtain white lac, it is necessary to have recourse to a chemical treatment by alkalies and to bleaching by pure alkaline hypochlorites, to which are added weak acids or oxygenated water.

The origin of Guatemala lac is identical with that of the lac of the Indies. The Madagascar lac is produced by the Gascardia Madagascariensis, which lives upon a tree of the order Lauraceæ. This lac is in spherical or ovoid masses (Fig. 2) traversed by a branch in the direction of the longer axis. The size of these reaches that of a pigeon's egg. The color of this lac is a grayish yellow. Its composition is similar to that of the Indian lac.

The Lac of China and Japan.—The lac of China and Japan is produced by incisions made in the trunk of the lac tree or varnish sumac (Rhus vernicifera), called "wrushi" by the Japanese. This tree is reproduced either by seeds or cuttings. It does not yield lac until it is eight or ten years old. The collecting is done as follows:

At about 30 cm. from the ground, the upper part of the bark is scratched with a knife (Fig 1, No. 2) for a width of 3 cm. and a length of 6. With the instrument shown in No. 1 of Fig. 1, incisions 12 mm. in width are made in a horizontal direction in the bark, other incisions are made with the point found on the

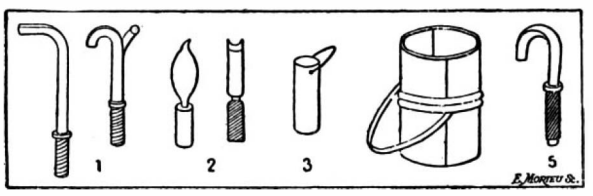

Fig. 1.—TOOLS AND APPARATUS USED IN THE WORKING OF LAC.

1. Rounded knives. 2. Knives. 3. Bamboo tube. 4. Bucket for lac. 5. Rounded knife.

Fig. 5.—PREPARATION OF COLORED LACS.

1. Bowl. 2. Mixing tool. 3. Method of operating. 4. Branch of sumac, showing incisions.

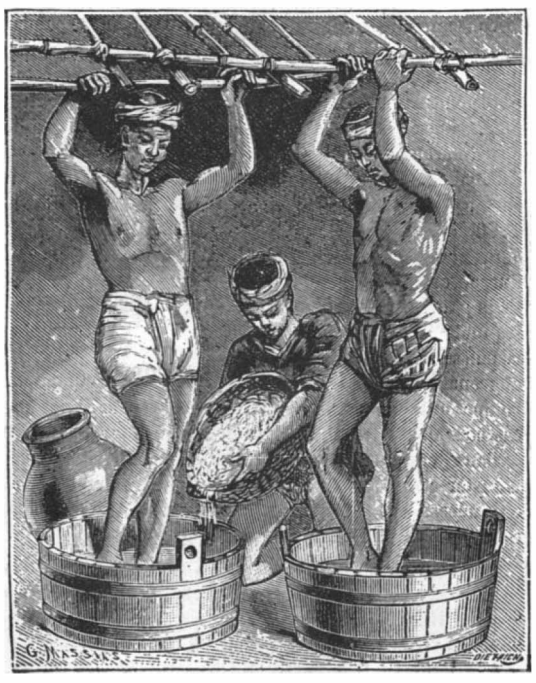

Fig. 3.—METHOD OF WASHING LAC.

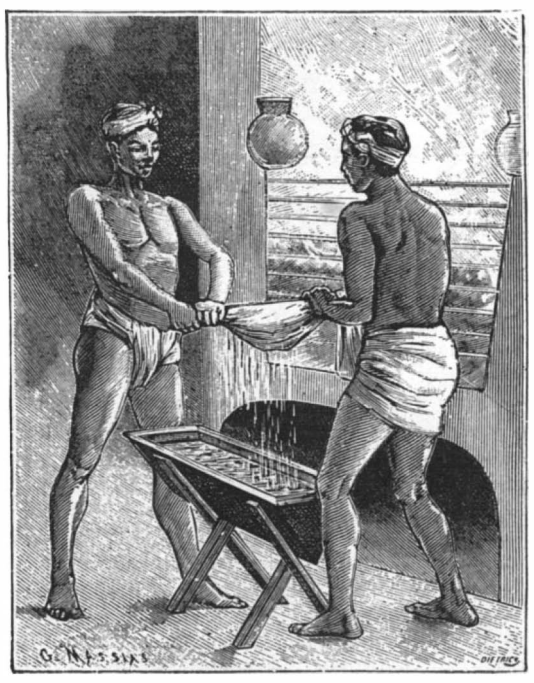

Fig. 4 PURIFICATION OF LAC.

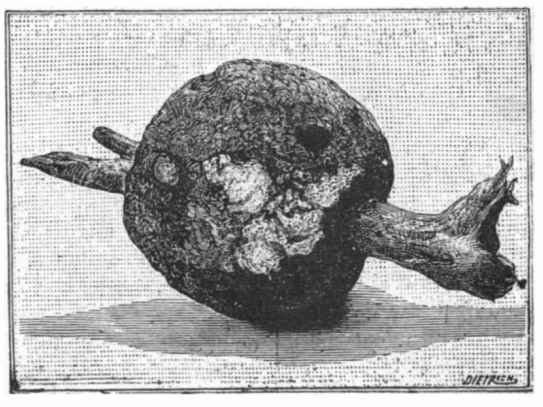

Fig. 2.—MADAGASCAR LAC.

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back of the knife. Four days after the incisions have been made, the lac begins to flow from the tree and is collected with a strip of wood and put into a bamboo tube (Fig 1, No. 3). After the lac has been removed from five or six trees, the collector returns to the first tree and makes an incision therein over the others, and so on with the remaining trees. It is necessary to remove the lac as soon as possible after it begins to flow, otherwise it would become brown, and even black in the air.

A workman can tap two hundred trees in a day. A tree of a circumference of from 15 to 20 cm. will yield from 90 to 95 grammes of varnish per season. Varnish of the first quality is collected from May to October. During the month of October the lac is of second quality. The varnish that comes from the branches is collected with a special knife (Fig. 1, No. 5). From the bamboo tubes the varnish is poured into a pail capable of holding 9 kilogrammes. The lac is stored in a similar vessel, but of a capacity of 30 kilogrammes.

When the tree ceases to yield varnish, the branches are lopped off and cut into pieces one meter in length, which are tied up in packages. After these have been dried for three or four days in the sun, they are immersed for five or six days in cold water, and are then incised with a knife in the form of a corkscrew. The juice that exudes is collected in a pail. This is lac of the third quality. The lac is preserved in a vessel which is hermetically closed. A hundred varieties of lac are known in China and Japan. Lac is mixed with iron or steel filings to form a paint that is used for covering wood and imitating slate. One variety of lac is prepared thus: Three hundred and seventy-five grammes of lac and 75 of oil are mixed and passed through cloth and 50 grammes of iron filings are added. Red lac is obtained by mixing lac with oil, vermilion and extract of Gardenia florida.

Colored lacs are obtained by mixing colored powders with ordinary lac. Black lac is obtained by exposing ordinary lac to the sun in a wooden bowl (Fig. 5, No. 1), which is placed in an oblique position (Fig. 5, No. 3). During this time a workman stirs the lac with a spatula in taking care to add a little iron filings to it. The Chinese lac is the product of the same tree (Fig. 5, No. 4). Lac is employed in the toy trade, marquetry, cabinet making, etc.—La Nature.

Engineering Tools at Pompeii.

Under the title of "Things of Engineering Interest Found at Pompeii," Professor Goodman lately gave his inaugural lecture in the engineering department of the Yorkshire College, Leeds. The lecturer remarked that he had recently visited Pompeii, and was not only charmed by the great beauty of the works of the ancient Romans, but also by their extreme ingenuity as mechanics—in fact, it was a marvel how some of the instruments and tools they were in the habit of using could possibly have been made without such machinery as we now possess.

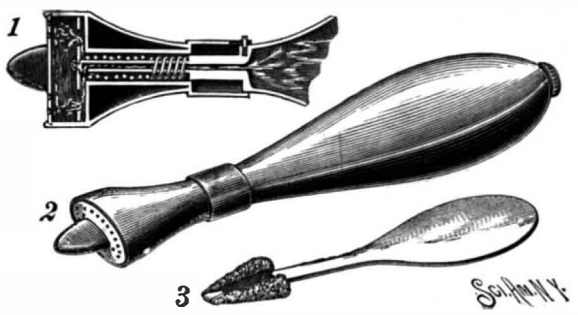
After explaining the situation and destruction of Pompeii by showers of ashes and mud, not lava, as is usually supposed, in the year 79 A.D., Professor Goodman showed a series of about fifty lantern slides, prepared from photographs taken by himself in Pompeii last Easter. The streets, he explained, were used as waterways to carry off the surface water, and probably sewage, from the houses. The pavements were raised about a foot above the streets, and stepping stones were provided at intervals for foot passengers.

The horses and chariot wheels had to pass between, and in many places deep ruts have been worn by the chariot wheels in the stone paved streets. The water supply of Pompeii was distributed by means of lead pipes laid under the streets. There were many public drinking fountains, and most of the large houses were provided with fountains, many of most beautiful design. The amphitheater, although a fine structure, capable of seating 15,500 people, was small compared with many in Italy. The bronzes found at Pompeii reveal great skill and artistic talent. The bronze brazier and kitchener were provided with boilers at the side and taps for running off the hot water. Ewers and urns have been discovered with internal tubes and furnaces precisely similar to the arrangement now used in modern steam boilers. Several very strong metal safes, provided with substantial locks, have been found. The locks and keys were most ingenious, and some very complex. On looking at the iron tools found in Pompeii, one could almost imagine he was gazing into a modern tool shop, except for the fact that the ancient representatives have suffered severely from rust.

Sickles, billhooks, rakes, forks, axes, spades, blacksmith's tongs, hammers, soldering irons, planes, shovels, etc., are remarkably like those used to-day; but certainly the most marvelous instruments found are the surgical instruments, beautifully executed, and of design exactly similar to some recently patented and reinvented. Incredible as it may appear, yet it is a fact, that the Pompeiians had wire ropes of perfect construction.

A BUTTONHOLE MOISTENER.

The illustration represents a simple device adapted to moisten the starched and stiff surface around a buttonhole, especially in collars and cuffs, to facilitate buttoning. It has been patented by Charles Miller, of No. 239 Fourth Avenue, New York City. As shown in perspective and section, Figs. 1 and 2, the body of the device has a projecting wedge-like lip adapted to enter a buttonhole, and there are apertures in the front part of an adjacent portion adapted to hold a sponge or other absorbent material, at the back of which is a spring-pressed perforated plate. An aperture in the handle, closed by a screw plug, provides for supplying water to moisten the sponge. Fig. 3 represents a modification of the device in which a sponge is attached in

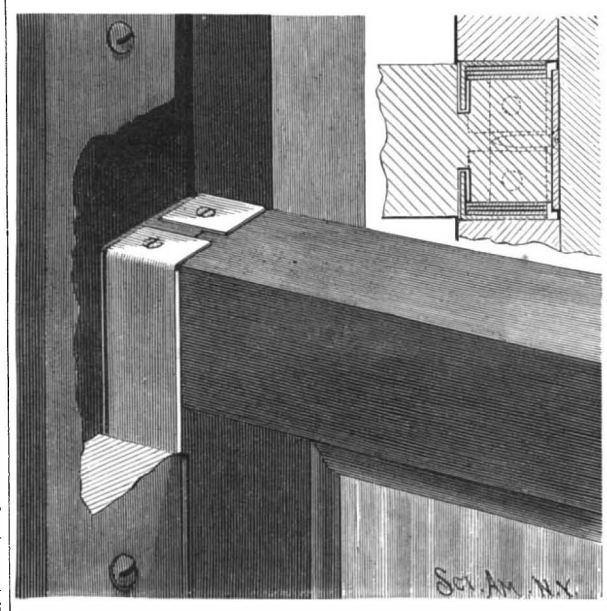


MILLER'S BUTTONHOLE MOISTENER.

pointed wedge shape to a suitable handle, the sponge to be then dipped in water as used.

AN IMPROVED CAR WINDOW SASH.

To enable a car window to be readily moved in its beads or frame, while the sash also fits so closely as to exclude wind or rain, the improvement represented in the accompanying illustration has been devised and patented by Henry V. Herrmann, of No. 97 Water Street, New York City. Near each edge and at each side of the sash is an L-shaped groove comprising a part extending parallel to the sash, and a part extending inwardly and transversely, as indicated in the sectional view, and fitted in each of these grooves is a movable metallic strip, interposed soft rubber strips serving to push the metallic strips outwardly to cause them to bind against the window beads, while making an easy and frictionless connection between the parts. The ends of the strips have flanges seated in recesses in the upper and lower edges of the sash. Secured to each vertical edge of the sash is also a metallic strip whose vertical edges project sufficiently to engage the edges of the rubber strips at the sides when the latter are spread by compression, thus preventing contact of the rubber with the wood of the window frame. This construction is designed to compensate for all shrinking and swelling of the wood of car windows,



HERRMANN'S SASH FOR CAR WINDOWS.

enabling them to be readily moved up and down at all times, while at the same time a tight and weatherproof joint is secured.

A New Waterwheel.

A waterwheel of remarkable construction has been introduced in the North Star mine, Grass Valley, Cal. It is eighteen feet in diameter, weighs 10,500 pounds and develops 250 horse power, running under 750 feet head, at 110 revolutions, and is directly connected to the shaft of a duplex compressor, compound tandem type, of same capacity. The design of this wheel is novel. From a cast-iron hub radiate twenty-four steel spokes, which are connected to a rim made up of angle iron properly shaped, having a slat for the buckets, which are bolted to the periphery, the strain being taken by four heavy steel truss rods. The large diameter of the wheel is for the purpose of giving proper speed to the compressor under the high head available; and the water is applied to the wheel through a variable nozzle controlled by an automatic regulator, the latter maintaining a uniform speed on the wheel, with a variation from full load down to twenty-five per cent of the same—a great economy of water.

Doctor of Machinery.

Among the multitudinous trades and professions in New York there are many which are entirely unknown, even by name, to the general public. One of the least known and most interesting is that of the expert in machinery. The work of a machinery specialist is far higher than that of a skilled engineer, and many years of experience and special training are necessary to fit the expert for his duties. There are only about half a dozen of these men in the country, one in every large city. When anything goes wrong with a machinery plant of whatever nature, the cause of which the engineer in charge, frequently the builder of the engines, cannot discover, the machinery doctor is called in. Every chief engineer of a big plant may be called a specialist so far as the machinery under his charge is concerned, but the specialist in machinery is an expert in engines of every description.

Though he has never seen the engine before, he rapidly diagnoses the case and prescribes a remedy, just as a doctor does for a sick patient. The instrument most used by him is a dentophone, which consists of a thin steel rod about a foot long, which he holds between his teeth and applies to the head of the cylinder. To the practiced ear of the expert every sound transmitted from the cylinder tells a story. The working of the piston in the cylinder, and, indeed, of the whole engine, can be heard distinctly in this manner by anybody, but it takes an expert to tell just what those sounds mean.

In the case of a mysterious knocking which was heard in the cylinder of the big driving engine in a large spinning factory not long ago, an expert was called in to determine the cause. Every method had been tried to discover where the trouble was, but without avail. Bearings were examined, the cylinder was taken apart, and every part well oiled, all to no purpose. When the expert came he traced the mysterious knocking from the cylinder, along the piston rod, crank shaft, and through the main shaft, away off among the looms, where one of the looms was found to be the cause of the trouble.

Often an expert's services are required in the case of synchronizing looms. If all the looms in a big spinning factory happen to beat together, as sometimes happens, the vibration is strong enough to bring the building down. For the same reason soldiers always break step when going over a suspension bridge, for otherwise the measured tramp of the many feet all striking the ground at the same time would seriously endanger the structure. The power of sound is also enormous when exerted in a particular way. Every substance in nature has a keynote, and when a sound of the same pitch is caused near it, a considerable amount of vibration is produced. When the great tubular bridge was being built across the Menai Straits, which divide England from the island of Anglesea, a traveling violinist nearly caused the collapse of the whole structure. He happened, while playing, to hold for a considerable time a note which chanced to be the keynote of the huge bridge structure. The sound echoed along the vast tube and reechoed with ever-increasing force until the whole bridge vibrated as if an earthquake were taking place. The bridge engineer, who was near by, instantly divined the cause, and stopped the playing of the violinist.

Part of the business of the machinery doctor consists in so arranging the distribution of looms and other machinery that their working will not endanger the stability of the factory. Defects in a boiler can also be instantly determined by the practiced ear of the specialist. A plate in the boiler is selected which is known to be in good condition, and he takes mental note of the pitch of the sound made when the plate is struck with a hammer. All the other plates are struck in the same way, and any one which does not ring true and conform to the correct pitch is examined and replaced. A case is on record where a machinery specialist was crossing the ocean and detected crystallization in the center of the shaft, thereby averting what might have been a serious accident in midocean. Measures were taken to strengthen the shaft in the place where the quick ear of the expert detected weakness, and when the vessel was docked his suspicions proved correct.

Few men even with the most exhaustive training can become experts at this business, as it requires a marvelous quickness of ear and delicate perception of sound with which few men are blessed. Technical knowledge is of little avail of itself, and a fine engineer might be a poor machinery doctor, just as a great musician might make an indifferent piano tuner. Whenever a big mill is erected, a specialist is always consulted as to the placing of the machinery, and his fee is generally well worth the expense and trouble which an injudicious distribution of machines may cause.—N. Y. Tribune.

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Testing House Pipes and Drains.

A good article on this subject, calculated to enlighten owners and occupants as well as plumbers, may be found in Domestic Engineering for September. These tests are named the water test, the smoke test, and the peppermint test. Presuming that the pipes are all in place and connected, but yet uncovered, and all openings closed by plugs (there are a variety of plugs for this purpose, generally constructed to become tight by expansion under pressure of a screw), the entire system is then filled with water. If the water at the highest point does not settle away after standing some time, the system is watertight. Connections should then be completed. If the water settles, there are leaks, which should be carefully sought out and stopped. After the connections of the fixtures are made, the system should be tested again. This may be done by the smoke test, or the peppermint test, or both in succession. The peppermint test is considered by most plumbers the more delicate, but it is more difficult to apply. The smoke test is performed by generating smoke and forcing it into the pipes, while all windows, doors, or other openings which permit free circulation of air into and through the building are closed. If smoke is detected anywhere in the building there are leaks, which may be discovered by the visible escape of smoke therefrom.

The peppermint test is applied by taking a small bottle of oil of peppermint and a can of boiling water on the roof and pouring it down the soil pipe, immediately closing the top and having someone in the house detect if any smell of peppermint becomes apparent, and where it comes from. This test requires delicate handling, and is troublesome. The person on the roof will have to remain some time, for if he comes into the house, he brings the odor of peppermint with him and spoils the test.

Maguire tabulates the following list of fifty-one specific insanitary and dangerous defects actually discovered in inspection of dwelling houses. These may prove suggestive to plumbers who are making inspections of systems of plumbing which are suspected of being defective:

1. Common brick or stone built drains under basement.
2. Large built drains, under or near dwellings.
3. Pipe drains of larger diameter than actually necessary.
4. Pipe drains broken, or with leaking points, saturating the subsoil with sewage.
5. Pipe drains with built or imperfect junctions.
6. Pipe drains under dwelling without sufficient fall.
7. Pipe drains with fall in the wrong direction.
8. Drains of any kind without proper intercepting traps.
9. Drains of any kind without constant free current of air throughout.
10. Drains without easy means of inspection.
11. Drains carried from public sewer direct under hall door steps and under scullery floor, instead of across open area.
12. Rat burrows from built drains, undermining floors.
13. Rat burrows from public sewers worked along outside pipe drains into houses.
14. Defective connection between soil pipes and drains.
15. Soil pipes inside houses under almost any circumstances.
16. Soil pipes inside or outside without ample ventilation.
17. Soil pipes through pantries, larders, or stores.
18. Defective, badly placed, or ill constructed water closet apparatus and housemaids' slopsinks.
19. Water closet cisterns with overflows joined to soil pipes or drains.
20. Safe tray sunder water closets joined to soil pipes or drains.
21. Two or more water closets or sinks on one soil pipe, untrapping each other when used.
22. Overflow pipes connected to soil pipes liable to become untrapped, all very dangerous.
23. Water supplies over troughs taken from water closets or other contaminated cisterns, and liable to be used by careless servants to fill bedroom carafes for drinking.
24. Taps for supplying bedroom water fixed over housemaids' slopsinks, liable to be polluted by splash from slops emptying.
25. House cisterns, with overflows, joined to soil pipes or drains.
26. Traps of every kind, without ample ventilation to guard them.
27. Scullery sinks connected direct to drains admitting foul air, not only through traps, but through joints of brickwork and plaster all round.
28. Bell taps, with loose covers on scullery sinks.
29. Gullies or traps in floors of sculleries, laundries, larders, or basement, etc., connected to drain, and usually dry and untrapped, or full of foul deposit.
30. Ventilating foul air shafts, discharging near chimneys or windows or ventilating openings.
31. Rain pipes used as ventilators for drain discharging foul air near bedroom windows or under roof eaves.
32. Rain pipes used as, or connected to soil pipes, likely to freeze soil pipe solid in severe winter.
33. Rain pipes passing down center of houses connected in any way to drains.
34. Open rain courses from valley gutters, passing under floors to outside down pipes connected to drain.
35. Rain pipes of low roofs, bow windows, or porches connected direct into drain.
36. Ashpits located near larder, pantry, or dwelling.
37. Ashpits liable to let moisture soak into house.
38. Ashpits capable of retaining moisture or unventilated.
39. Rat burrows from defective drains in neighboring premises.
40. Defective drainage or fittings in neighboring premises.
41. Any direct communication with drains of neighboring premises.
42. Water tanks in areas, near ashpits or sculleries, or with any connection of overflow to drain.
43. Bath waste or overflow pipes connected to soil pipes or drains.
44. Wash hand basin wastes or overflows connected to soil pipes or drains.
45. Water closet cisterns under bedroom or parlor floors.
46. Cesspools near houses, or unventilated anywhere.
47. Cesspools or drains near wells.
48. Drains crossing your house from neighbor's premises.
49. Field or surface water drains, with open joints under basement connected to house drains direct.
50. Damp basements or damp walls.
51. Drinking water defects of source supply or storage.

What Shall We Eat?

The Canadian Baker and Confectioner, condensing a pamphlet issued under the auspices of the United States Department of Agriculture, prepared by W. O. Atwater, Ph.D., professor of chemistry in Wesleyan University, on the nutritive value of food products, says:

"A quart of milk, three-quarters of a pound of moderately fat beef—sirloin steak, for instance—and five ounces of wheat flour all contain about the same amount of nutritive material; but we pay different prices for them, and they have different values for nutriment. The milk comes nearest to being a perfect food. It contains all the different kinds of nutritive materials that the body needs. Bread made from the wheat flour will support life. It contains all of the necessary ingredients for nourishment, but not in the proportions best adapted for ordinary use. A man might live on beef alone, but it would be a very one-sided and imperfect diet. But meat and bread together make the essentials of a healthful diet. Such are the facts of experience. The advancing science of later years explains them. This explanation takes into account, not simple quantities of meat and bread and milk and other materials which we eat, but also the nutritive ingredients or 'nutrients' which they contain."

The chief uses of food are two: To form the material of the body and repair its wastes; to yield heat to keep the body warm and to provide muscular and other power for the work it has to do. Dr. Atwater has prepared two tables showing, first, the composition of food materials, the most important of which are the nutritive ingredients and their fuel value; second, the pecuniary economy of food, in which the amount of nutrients is stated in pounds. In the first table we find that butter has the greatest fuel value, fat pork coming second, and the balance of the foods mentioned being valued as fuel in the following order: Cheese, oatmeal, sugar, rice, beans, cornmeal, wheat flour, wheat bread, leg of mutton and beef sirloin, round of beef, mackerel, salmon. Codfish, oysters, cow's milk, and potatoes stand very low as fuel foods.

From the second table we learn that the greatest nutritive value in any kind of food of a specified value (Dr. Atwater takes 25 cents' worth of every kind of food considered) is found in cornmeal. In 10 pounds of cornmeal there are a trifle more than 8 pounds of actual nutriment. In 8⅓ pounds of wheat flour there are over 6¼ pounds of nutriment; in 5 pounds of white sugar there are 4½ pounds of nutriment; in 5 pounds of beans there are 4 pounds of nutriment; in 20 pounds of potatoes there are 3¾ pounds of nutriment; in 25 cents' worth of fat salt pork there are 3½ pounds of nutriment; in the same value of wheat bread there are 2¼ pounds; in the neck of beef, 1¾ pounds; in skim milk cheese, 1¾ pounds; in whole milk cheese, a trifle more than 1½ pounds; in butter, 1½ pounds; and in smoked ham and leg of mutton about the same; in milk, a trifle over 1 pound; in mackerel, about 1 pound; in round of beef, ¾ of a pound; in salt codfish and beef sirloin, about ½ a pound; in eggs at 25 cents a dozen, about 7 ounces; in fresh codfish, about 6 ounces; and in oysters at 35 cents a quart, about 3 ounces.

Death of a Famous Inventor.

Something like forty years ago one of the earliest clients we remember, as an applicant for a patent, through this office, was the gentleman referred to as follows in the American Carpet and Upholstery Trade:

Sylvanus Sawyer, who died at Templeton, Mass., recently, was one of those old time types of New England inventors to whom the intricacies of machinery are a perpetual delight and pride. Outside of a number of small though useful inventions that he made, there are two that were of importance enough to give him more than a local reputation; and from them he, unlike many other inventors, realized enough to allow him to spend his last years in peace and in the pursuit of those studies in which he was wont to employ his spare hours while not busy at the work bench.

He came from good New England stock, his father being Malcom J. Sawyer, well known through the town, in accordance with the Yankee fondness for nicknames, as "Praying John" Sawyer. He was born in that place in 1822, his father living on a small farm and being by occupation a farmer and a stone cutter. In his early days Sylvanus showed a remarkable taste for mechanics, and was of a most ingenious turn of mind. He was hardly out of his teens when he had fitted up a little workshop on his father's farm, where his inventions were perfected later. The first invention of note was brought to perfection about 1850, and was a rattan splitting machine. Previous to this, the rattan from which the cane was made for seating "cane chairs" had been cut by hand—a slow and laborious process. The invention consisted of a head with knives so set that when the rattan was fed into the machine by rollers the strips were neatly cut off and curled up ready for use. This proved to be of great service in that section, where the chair business was the leading industry, and from its invention Mr. Sawyer realized largely.

Minor inventions occupied his attention for some years, and although all of them were of more or less value, it was not until about 1854 that he conceived the idea of a rifled cannon from which could be discharged an explosive shell. He had a cannon cast after this pattern in Fitchburg, rifled, and having a caliber about 3⅛ inches in diameter and 5 feet long. He then brought it up to Templeton and had explosive shells of an original and peculiar pattern made, they being grooved to fit the rifling of the cannon and give it that rotary motion now so universally used. The shell was hollow and in shape not unlike an acorn, and on its tip was an opening through which powder could be poured. A fulminating cap was the final arrangement, so adjusted that when it struck any object the contents of the shell would be ignited and an explosion take place.

When the test of his cannon was made (1854), his shell went straight to the mark and exploded with due precision, tearing the target into flinders. Thus successful was the first rifled cannon ball ever fired in this or any other country. Later, after many experiments, it was adopted by the War Department as an improvement of value.

Myopes.

Dr. G. Sterling Ryerson, Professor of Ophthalmology in Trinity Medical College, Toronto, says: Myopia being essentially a condition due to abuse of the eye, one is constantly obliged to say "don't" to patients. It occurs to me that it might be useful to put these prohibitory rules in aphoristic form:

1. Don't read in railway trains or in vehicles in motion.
2. Don't read lying down or in a constrained position.
3. Don't read by firelight, moonlight, or twilight.
4. Don't read by a flickering gaslight or candlelight.
5. Don't read books printed on thin paper.
6. Don't read books which have no space between the lines.
7. Don't read for more than fifty minutes without stopping, whether the eyes are tired or not.
8. Don't hold the reading close to the eyes.
9. Don't study at night, but in the morning when you are fresh.
10. Don't select your own glasses at the outset.

It would almost seem as though some of these rules were too obvious to require mention, but practical experience shows that myopes abuse their eyes just in the ways stated. Reading by firelight or by moonlight are favorite sins. Reading lying down tends to increase the strain on the accommodation, and while traveling tires the ciliary muscle because of the too frequent adjustment of focus. In short, anything which tends to increase the quantity of blood in the organ favors the increase of the defect, leading in extreme cases to detachment of the retina and blindness.—The Canada Lancet.

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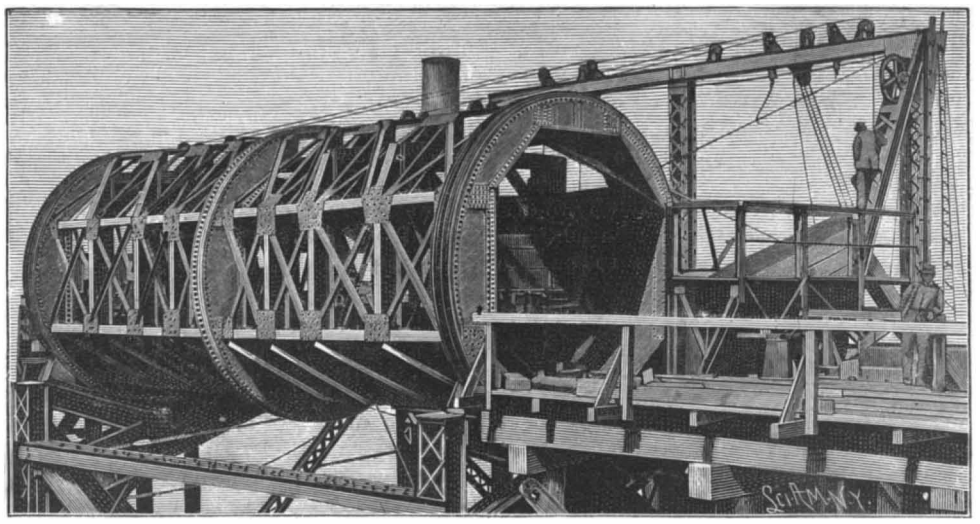
A COAL CAR DUMPING MACHINE.

Great progress has been made during the past two years in loading and unloading vessels for shipment, and most especially is this true at the lake ports, where it is necessary to handle with great dispatch cargoes of iron ore and coal. The old method, which existed for years, was principally hand work, and the cost of unloading coal by hand was about twenty-five cents a ton. The coal was transferred from cars to vessels by slow working cranes, which could do but little in the course of a day. At many ports there were not even cranes, and wheelbarrows and "navvies" kept a vessel tied many hours at dock when she might have been on her way making something for her owners.



A COAL CAR DUMPING MACHINE—THE CAR HANDLING CYLINDER.

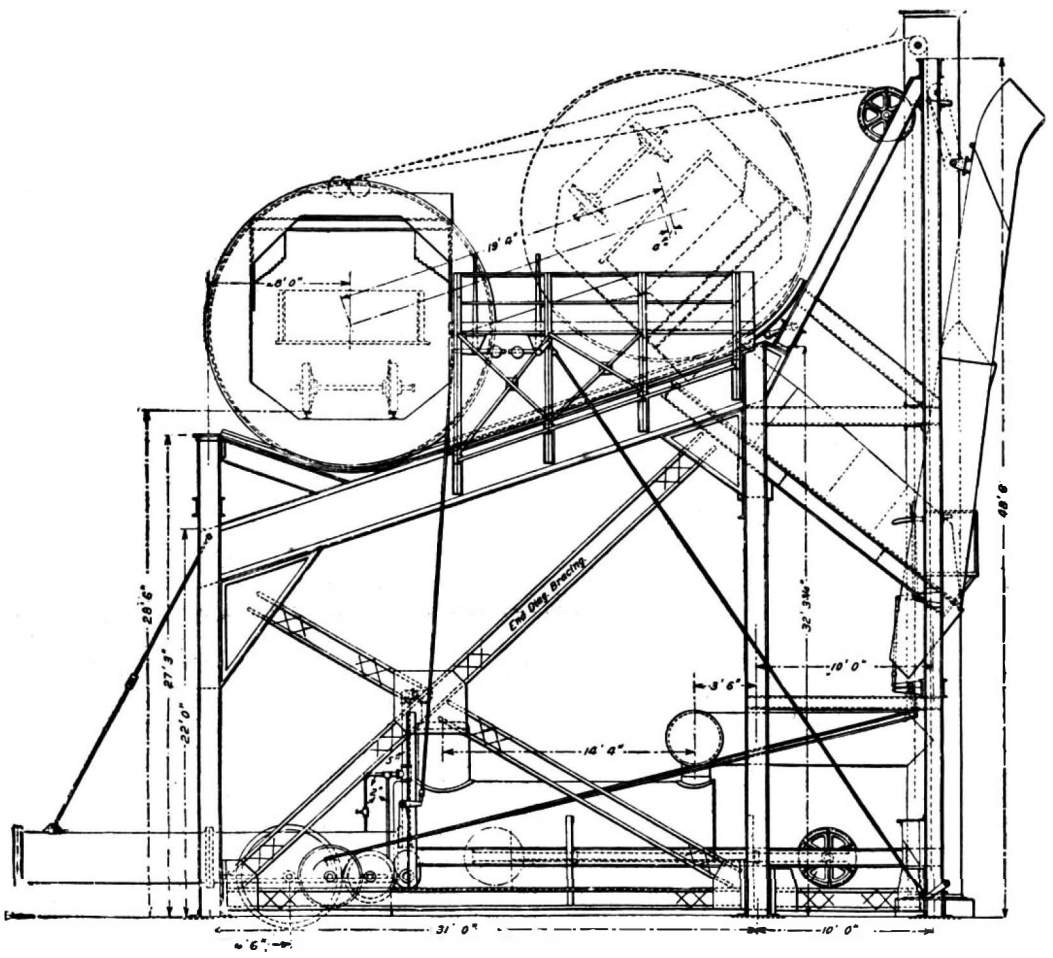
Of the many efforts which have been made to perfect machinery for doing this work, none seem to have met with the success reported of the Long dumping machine, recently perfected in Cleveland by the Excelsior Iron Works Company, and which is shown in the accompanying illustrations.

At a very recent test on the docks of the N. Y., P. & O. Railroad in the city of Cleveland, this machine actually made a record of unloading three ordinary railroad coal cars into a vessel in three minutes. The coal was what is known as ordinary lump Massillon, and it was transferred from the cars to the vessel with absolutely no assistance other than the handling of this machine.

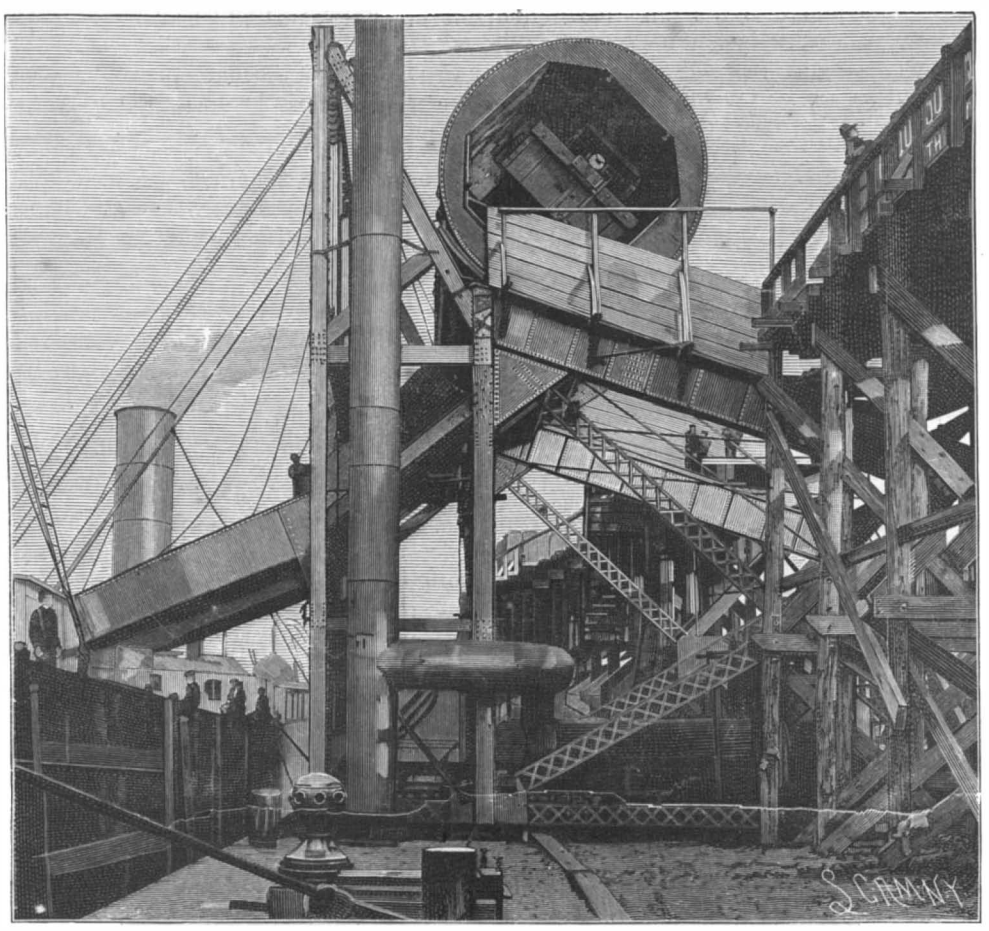
The machine is the invention of Mr. Timothy Long, a practical designer who has been connected with the Excelsior Iron Works for a number of years. The car dump consists mainly of a large cylinder, with an inside diameter of 11 feet, and an outside diameter of 16 feet; the length being 40 and the circumference 52 feet. It is set 28 feet above the level of the docks, but on a level with the company's tracks, one of which runs through the cylinder when the latter is at rest. The coal-laden car is set in the cylinder by means of a switching engine; and by the time the car is detached from the train, it is clamped firmly by means of a beam running along the side. This beam acts by hydraulic pressure and the car is held rigid by four iron clamps which fall upon the top of the car's sides, and which are firmly held in place by keys fitting in cogs. These clamps act automatically when the cylinder begins to roll.

This clamping process is the work of an instant, and, by means of a lever worked from the end of the cylinder, an engine on the dock level is started. This engine has a cylinder 30 inches in diameter by 19 feet stroke of piston, and a single stroke is all that is necessary to roll the cylinder up an inclined plane into the position shown in one of the engravings, when the coal rolls out compactly into the chute. When the coal leaves the car, the chutes stand out horizontally, which prevents the coal acquiring any momentum. As soon as the cylinder begins to roll back, the chutes are gently lowered by means of another engine on the dock level, and operated by a man standing between them, until the coal is allowed to pour gently into the hold, the breakage being thus reduced to a minimum, which is something less than when it is handled by being shoveled into buckets and then dumped into the hold by means of "whirlies." Both the cylinder and chutes are operated by means of wire cables, and the operation of the whole machine is so simple as to add greatly to its value, there being no complicated machinery to get out of order. The cylinder is made absolutely accurate in its movements by a series of four inch holes being bored in the perimeter near each end of the cylinder, which fit upon cone shaped pins on the inclined track. This gives all the advantages and none of the disadvantages of a cogwheel arrangement.

The great points in favor of the Long car dumping machine are as follows: The machine operates rapidly; it empties cars of all sizes, in any order, without adjustment being necessary; and the coal breakage is reduced to an absolute minimum. The machine is comparatively cheap as to its first cost, and is economical of operation. The construction, while solid, is not complicated, and can be erected at low cost. Only three men are required. These are the engineer or fireman, a man to operate the cylinder, and a third to operate and control the movements of the chutes. The machine has duplicate boilers, one for use in case of emergency; but the entire apparatus is operated with only 80 pounds of steam. The stoppages usual to any new type of machine have, of course, occurred, but the changes necessary were very trifling in character, and in no way reflected upon the usefulness of the machine.



A COAL CAR DUMPING MACHINE—END VIEW.



A COAL CAR DUMPING MACHINE—THE CAR BEING DUMPED.

Long Tongued Bees Needed.

A correspondent of the Country Gentleman says: The giant bees, which are the principal source of honey supply in the Madras Presidency, are about one-third larger than ours. They build one single sheet of comb, about 18 by 18 inches, and 3 or 4 inches in thickness, attached generally to the under side of protected rocky cliffs. I now not only believe there are several ways by which a cross of these bees with the Italians can be made to increase their size, but (better still) that these India bees can be domesticated in our frame hives by using comb foundation, with larger cells, and in wider frames—probably 1¼ to 1½ inches. It might also be necessary to use some of our frames with finished drone comb alternately with frames of foundation, which would compel them to build even and straight combs. If we can get a fixed type of bees with tongues long enough to sip all the honey from red clover blossoms, the money value and the food value of our clover crops would be doubled.

I wish the government would either send as consul to the Madras district a practical apiarist, or (better) send one as special agent to experiment with the giant bees on the lines I have referred to. Five thousand dollars would, probably, make a fair test. If a new bee or cross can be introduced here, it should be done through experiment stations at cost, or at reasonable prices, to prevent extortion by the queen dealers.

Out of 120 colonies in my two apiaries, some five or ten of them have stored this season considerable red clover honey. But they can only get a small part of it from the shortest blossoms. One-sixteenth to one-eighth of an inch added to the length of their tongues or proboscis would be worth millions to us.

To Mend Broken Plaster Casts.

Paint the broken surfaces over two or three times with very thick shellac varnish, and at each application burn out the alcohol over a flame. When the shellac is sufficiently soft, press the parts together, and hold in position till cool. It will be as strong as it was before broken.

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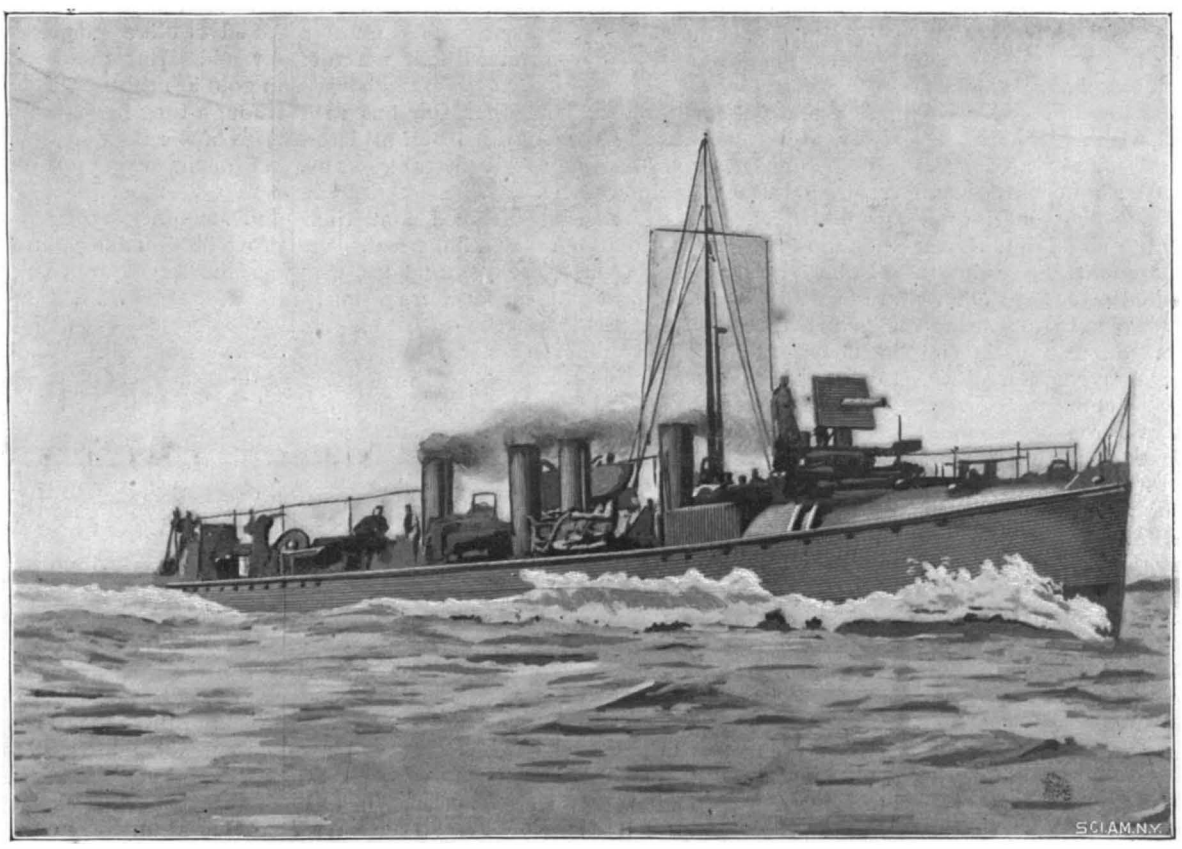
THE RUSSIAN TORPEDO BOAT DESTROYER SOKOL.

Thirty knots an hour has been the mark which the builders of torpedo craft and swift river launches have, of late years, been striving to reach. The torpedo boat destroyer Sokol was the first boat to win this coveted distinction; and the accompanying illustration shows her as she appeared on the measured mile, when running at the rate of 30¼ knots, which is equal to about 35 miles an hour.

The Sokol was built for the Russian government by Yarrow & Company, of Poplar, London. She belongs to a class of boats which were built as an answer to the torpedo boat proper. Their duty is to give chase to, run down and destroy, these small craft; and for this purpose, the destroyer is given larger dimensions, higher speed, and a powerful battery of rapid-fire guns. The Sokol is 190 feet long by 18 feet 6 inches beam. Her horse power for her size is enormous, being about 4,000; and it shows at what great cost these high speeds are obtained. She is twin-screw, and her engines are of the three-stage, compound type, that the builders use in this type of vessel. Steam is supplied from eight water tube boilers.

The high speed of the Sokol is not due to the horse power alone—great as this is—but it is in large measure owing to careful attention to detail in the construction of the hull and machinery. Wherever it was possible to save a pound of weight it has been done. The hull is built of nickel steel, a material which is more rigid and possesses greater strength than the customary mild steel of ship construction. In the fittings of the hull aluminum has been used wherever great strength is not required; and weight has been saved in the engines by using high class bronzes, which have a high unit of strength for their weight.

In the endeavor to get the highest possible speed on a given displacement, the torpedo boat builder has exercised a powerful influence on naval design in general. It is doubtless largely owing to his experience as a builder of torpedo boats and swift launches that Mr. Herreshoff holds the first place as a designer of swift sailing yachts.



THE RUSSIAN TORPEDO BOAT DESTROYER SOKOL.

The Ruined Gila Cities.

The attention of people interested in archæology and ethnology generally has long been directed to the ruins of the cliff dwellings in northern Arizona and southern Colorado, but there are comparatively few persons outside of Arizona and New Mexico who know that in southern Arizona there is a field far more interesting and of wider range. So eminent authority as Major J. W. Powell, recently of the United States Geological Survey, is quoted in support of this statement. Conservative estimates put the population of the Gila country at fully 2,000,000 when it was at its height.

The Gila remains have been but little explored because of the inaccessibility of the region, the intolerable dry heat during two-thirds of each year, and the total lack of water where it is needed. The mining prospectors who have tramped for years over all the mountains and through every valley in the Territory have given no heed to this part of the Gila country, because, no water being there, it would be useless to attempt to develop a mine even on good surface indications. An expedition under Frank Cushing did some work near Los Muertos, which is known in the Southwest as the Pompeii of Arizona, but with the breaking down of his health the enterprise came to an end. The area of the country in which the remains of a prehistoric people are found is some 300 square miles. It extends from the junction of the Gila and Colorado Rivers eastward to the Superstition Mountains, and from Phœnix on the north almost to the Mexican line. Near Casa Grande the most extensive Indian remains are to be found.

The country is a ruin from one end to the other. All parts of it bear unmistakable evidences of irrigation canals several hundred miles long and built with exactness and skill, and of cities of 30,000 and 40,000 population. One can walk for miles and find every foot of the sandy surface more or less mixed with pieces of broken pottery. The paint is still on them, and is not in the least faded, though it has lain exposed for ages. In the locality of Mesa City and Tempe an overflow from the Gila at some distant period washed against the ruins until they crumbled and were spread out level with the country. Back ten miles from the Gila River the ground is higher, and was once the site of a city. Portions of the wall by which it was protected are still standing, more than twenty feet in thickness. Inside are the mound like ruins of the houses, which, being less durable, have crumbled. The buildings must have been very large, for in some instances the mounds are 300 feet in length by 200 in width and 20 in height. The space inclosed by the wall is about fifty miles by three. Much of the country is very little higher than the present bed of the Gila, and at one time a branch of that stream must have flowed into a basin and formed a natural reservoir. There was a rise of about ten feet greater at one point between the basin and the river, and the sandstone formation shows unmistakable signs of having been cut by artificial means, perhaps with the idea of assisting the entrance of the water by enlarging the passage. Five canals lead out of the basin, all on the south and west, which confirms the belief that it was once a reservoir formed chiefly by natural causes, and used to store water against the periods of drought. The prehistoric city is laid out north and south, at least, in a majority of instances the streets run to the cardinal points. The walls seem to vary a little from this rule; in fact, are crooked in places, as if they might have been constructed for the support of bastions or towers. This city and the one containing an old fort further down the river are the only ones in which the writer ever found any evidence of preparation for war. It seems as if the races who lived in this Gila country were either so numerous that they feared no attack or they had no enemies with which to contend. South of Phœnix, on the mesa, are the ruined corrals or stock pens in which their animals were kept. Many finds prove the purpose for which they were used. What the animals were is not so easily determined. On slats found in ruins south of the Salt River are splendid figures of llamas. In the ruins that have best withstood the exposure of the ages many interesting specimens of the ceramic art have been found. Ollas of all shapes and sizes, urns containing the ashes of the dead, and jars partly filled with parched corn and beans are found in a remarkable state of preservation. It seems as if the entire city had been swept by a flood and the earthen house melted down, or they were shaken by an earthquake and toppled into a thousand fragments, giving the inhabitants barely time to escape. Few of the skeletons that the amateur diggers in the ruins have taken out show signs of mutilation or have broken bones. The people appear to have died of suffocation or some natural cause that left no mark upon the frame. In working in several spots where bones have been found deeper digging has brought to light large quantities of bone dust as fine and light as gunpowder. In one spot near Tempe, several tons of bone dust have been found recently, lying in what appears to have once been a trench some seventy feet long and two deep, nine feet below the surface of the sun-baked earth. The edges of the deposit of bone dust were broken and uneven, so that it could not mark a place of burial. Does it consist of the remains of animals or is the dust that of human beings? If the latter, was it the result of funeral rites, or were the bodies deposited there by some great flood that came over the land without a warning? The majority of the skeletons discovered in the Gila Valley are in good condition, and it is therefore not easy to reconcile this fact with the finding of the great deposits of bone dust.—New York Sun.

An American on the British Empire.

The Hon. Justice Field, of the United States Supreme Court, recently passed through Canada, and a long account of an interview with him appears in the Montreal Daily Witness. In reply to a remark by the correspondent, who observed, "You have beaten us in the race for population," the judge said, "There were special causes for that. But you are bound to prosper. Greatness will come in time. It always does where England plants her foot; and that not because of her might, but for a nobler reason. Wherever England plants her foot she at once establishes order; she makes laws; she protects life and property. And those who place themselves under that flag stay under it, assured that they can sit under their own vine and fig tree. That is the secret of the British Empire—that it stands for order, for the sacredness of human life, for protection of every interest, however humble. You have a great country and are part of a mighty empire. When I think of Australia, New Zealand, South Africa, India and this great country to the north of us, I am filled with wonder." "Do you think this unwieldy empire will last?" "Justice and righteousness will make it last," replied the venerable judge. "These form the cement which binds nations together. If they are absent, no nation can prosper. It may appear to be great for a time, but it will eventually go down in ruin. England's rule, in the main, is for justice and righteousness, and therefore, I would safely predict permanence for her great empire."

Speaking of the relations between Britain and the United States, the judge said: "The only rivalry between the two countries, enlightened and tolerant, will be an industrial rivalry, of which we cannot have too much. English-speaking people, whether American or British, understand justice and will eventually do right. It is not their genius to do other. If there be irritation it will pass away; local acerbities will vanish. We are growing out of localism; we are taking the larger view." "Whether Canada will go on to nationhood," said the judge, in answer to another question, "or become a part of the United States, who can tell? One thing is certain—Canada can never be coerced to join us. No sane person would think of such a thing. If, after carefully considering the problem, both countries agree that it would be best to obliterate the imaginary boundary line and to become one, then I think their desires could be accomplished. But it is madness to talk of coercion. The day of force is over. We are having, and will have more and more, the reign of wisdom; and it will be wisdom and good feeling which will ultimately determine this matter."

Safety Appliance for Electric Wires.

We have received a photograph illustrating a test of a safety appliance for electric wires, in which the inventor, Mr. A. E. Hutchins, of Detroit, Mich., is represented as standing upon the wet ground, with naked feet and having in his mouth and wrapped around his body a wire connected with an electric line, said to be carrying a current under a potential of 3,000 volts.

The electric wire thus handled with impunity would produce instant death but for the safety appliance devised by Mr. Hutchins. This appliance consists of a bracket at the top of the pole which supports the line, the bracket having at its extremity a pear-shaped loop, the inner portion of which has a sharp edge. The wire extends through the loop without touching, and is held normally at such a distance from the side of the loop as to permit of the swinging of the wire and all usual vibrations, without forming any contact with the loop. When, however, the line breaks it drops upon the sharp edge of the loop, which cuts the insulation, if there be any, and forms an electric contact with the bracket, and the bracket being connected by a wire with the ground, the fallen wire is immediately grounded and the portion lying outside of the loop or within reach is thus rendered harmless.

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Cycling and Heart Disease.

Under the above caption, in the Asclepiad, No. 43, vol. xi, third quarter, 1894-95, Sir B. W. Richardson publishes a revision of the interesting paper which he read before the Medical Society of London in January, on cycling in relation to diseases of the heart. The author has himself been a cyclist since 1877, and his powers of accurate observation and philosophic grasp are well known. What he has to say on this subject is therefore of great importance. The rapid increase in the number of persons using bicycles and the immoderation exhibited by some of the min the exercise will unquestionably, before long, introduce among the inflammations, neuroses and muscular affections, cycler's cramp, cycler's heart, cycler's muscular strain, cycler's joints, etc.

Confining our attention to the effect of cycling upon the organs of circulation, Sir B. W. Richardson divides them into two classes: First, the immediate effects of the exercise upon the heart and circulation as observed on the rider. Second, the after effects as observed in the consulting room or sick chamber.

First.—In all riders, at all ages, in experts as well as beginners, there is in the beginning of each attempt a quickening of the circulation, although there may be no consciousness of the attendant phenomena. The pulse is full and bounding, and throughout the ride there is a continued rapidity not amounting to the same degree as at first, but rarely falling to less than one hundred pulsations per minute. The rise of the pulse is considerably increased in climbing, with a fall on horizontal planes and a well marked fall in descents, especially if the feet be taken off the pedals, as is the practice of accomplished cyclists. Even if cycling be daily continued, these phenomena will be excited. The heart, if examined during a few moments of rest, in order to permit of auscultation, is full and bounding like the pulse. The external impulse is very pronounced, and the sounds are full, with not unfrequently an accentuation of the second sound. So long as the exercise is continued, an increase of cardiac motion is observable, the act of movement on the machine seeming sufficient to keep the circulation in vigorous and equal tension. This accounts, according to Richardson, for the astounding journeys that the fully trained cyclist can undertake, when in his prime, and for his endurance against sleep. There are some peculiar points connected with this overaction of the heart. For example, no rider is so embarrassed by it as to cause him to stop abruptly in order to dismount and seek rest, while one rider, who could not climb a flight of stairs on foot without resting many times during the ascent, complaining of breathlessness and palpitation, could, on the machine, climb hills without distress. It would be wrong to conclude from this that cycling is not injurious, because there has not been length of time enough to determine from many cases what the ultimate effect of long-continued riding may be. The evidence on this particular subject is unfavorable at a general glance, for several accomplished and skillful riders have, after some years, succumbed prematurely from diseases of the circulation, but there has been no sufficient pathologic inquiry to prove in what way the damage was developed.

Second.—Dr. Petit suggests that out of one hundred riders there is sure to be one at least who is affected with heart disease. The wonder, therefore, is why so few suffer in an immediate manner from the exercise. Petit seems to have known of two or three sudden deaths, but he does not tell how many hundreds or thousands of persons form the body of riders out of which this conclusion was drawn. Richardson has been giving attention to the matter since 1887, and knows of only five or six instances, physical accidents excluded, in which a cyclist is said to have died during the exercise, and he is not sure that in any of these cases the fatal result was to be attributed to the influence of the exercise upon the heart. If, however, we have to consider the continuous effect for some years on those in whom the elastic tissues have lost much of their primal elasticity, it is certain that there are many men and women in whom the circulation becomes disturbed ("distrained" is Richardson's word) by an arduous pursuit of the exercise. Fortunately there comes with this a "saving" distaste for the exercise which gives protection. For some obscure reason, one who has been a cyclist gives up using his wheel. Upon examination it is found that there is a feebleness of the circulation, coldness of the extremities and an unnatural langnor and inability to sustain fatigue and a rather quick weariness if exercise on the machine be tried.

Contrary to what would be expected theoretically, cycling exercise carried out with moderation two or three times a week, if it be done without strain, as in hill climbing, and if it be not too long continued, as in a long stretch, proves an actual remedy in cases of fatty degeneration of the heart. Richardson relates, indeed, a case in which the exercise proved beneficial to a man of over seventy-five years, suffering with symptoms of senile failure of the heart. Horse exercise he believes not in the least degree comparable with cycling in these cases, while walking in any degree is all but impossible, because the limbs have to carry the weight of the trunk, and fatigue, which is very wearing, leads to more exhaustion than is balanced by the exercise.

Gouty dyspepsia is often very much benefited by moderate cycling. In cases of marked valvular disease, the exercise is not to be advised, but there are some cases in which it has been undertaken without apparently resulting harmfully. Intermittent pulse and palpitation may be improved by exercise on the tricycle rather than the bicycle, so that the patient may at any moment stop without alighting and shall not undergo the nervous strain which attends bicycling. In anemia, the exercise may be directly curative, especially in the case of women.

Overstrain in cycling is not merely a theoretic danger, but has actually been observed. There are two classes of subjects who are affected injuriously. The first are young persons, often mere boys, who are made to ply the machine, probably heavily loaded, for commercial duties and business. The boy really does the work of a horse in this way; he seems to enjoy it, and the employers, knowing no evil from it, let him do all that may be done. On account of the immaturity of the heart and arteries, they are easily expanded under improper pressure, and cardiac hypertrophy and disproportionate development of the heart and lungs is the result. Secondly, there are the extreme conditions shown in those remarkable athletes who enter into competitions that have never before been dreamed of in the history of the world.

The heart of the cyclist accomplishes in twenty-four hours a labor equal to lifting one hundred tons one foot from the earth, and this without sleep or rest on the part of the rider. Such feats cannot be repeated many times by one person without mischief to the heart

As a matter of fact, Sir B. W. Richardson has seen many cases, even among the so-called best athletes, in which the heart has become large, irritable, extra sensitive and easily intermittent. The arteries are distended, their elastic tissues enfeebled and their functions, as regards nutritive repairs, imperfect.

In both these classes of cases, the young boys who are made to work too hard and the athletes who engage in extravagant competition, degenerative change in the organs of the body generally is a result of the injury done to the heart and arteries. In advising patients on the subject of cycling, it is often more important to consider the state of the vessels than that of the heart. Enfeebled and worn-out arteries are more dangerous than an enfeebled heart.

There are three sets of acts which are most injurious in cycling; these are straining to climb hills or to meet head winds, excessive fatigue, and the process of exciting the heart and wearing it out sooner by alcoholic stimulants, to the omission of light, frequently repeated and judiciously selected food.—Philadelphia Polyclinic.

Motor Carriages.

When going to the carriage depot of Messrs. Peugeot, which is situated in the Boulevard de Gouvien St. Cyr, I met with many little experiences. On one occasion, what appeared to be a French engineer dressed in a blue blouse and overalls, and engaged in cleaning an engine, proved to be M. Pierre Giffard, of the Petit Journal and Le Vêlo. We soon became good friends, and he told me that he was learning his engine. Later in the day he divested himself of his working clothes, and took me for a drive on the vehicle he had just purchased. On another occasion M. Menier, of chocolate repute, arrived with his horseless carriage, gave some instructions, and left again in the same manner. There also came a gentleman and his wife from New York to examine the carriages, and in the course of conversation it turned out that he was an electrical engineer, whose name was known to me, as well as mine to him. One afternoon an elderly French gentleman arrived with his wife on a similar errand. I did not listen to the whole conversation, as it would have been impolite, but I could not help overhearing a good deal, as they were close to my side. The lady seemed greatly surprised that the carriages were not wound up before starting. Upon being told that petroleum was employed for the power, she expressed her astonishment that a light should be employed in any part of the engine, believing that the carriage was run by the weight of the petroleum alone. This worthy couple were so dissatisfied with the present condition of mechanical knowledge that they went away in disgust. This is one of the small trials which the engineer of the establishment has to put up with in the course of daily life. In crossing the main avenue, which runs from the Arc de Triomphe to Neuilly, we met a smart little victoria without a horse. A lady, elegantly dressed, was seated inside, with a liveried coachman on the box. I was told that this lady was a well-known actress of the Theatre de Français, who lived outside Paris, and went daily to the Magasins du Louvre and the Bon Marché to do her shopping, the distance traveled being no less than five miles each way. She had started this carriage from motives of economy, and her coachman had been broken in to drive the new horse. We met many other such vehicles, but they were chiefly out on experimental runs. In one case it was a carriage used for advertisement purposes by a well-known establishment—Le Chat Noir.

Improvement in Gold Mining.

Recent reports of increasing production of gold in this country and elsewhere have attracted attention to new methods of mining and treating the ore, which have greatly reduced the cost of obtaining the metal, and made possible the working of mines containing a very small percentage of gold. In the Colorado gold district the best results in this direction have not yet been reached. It is predicted that when the time comes for the enormous deposit of low grade ore proved to exist at Cripple Creek to be treated anywhere near as cheaply as the cost at Johannesburg, Cripple Creek will produce more gold than Johannesburg, where ores are treated by stamp mills, the "tailings" being passed through cyanide mills. Ten years have been spent in reaching the high state of efficiency and economy there.

Rossiter Raymond, a mining engineer who has had experience in the Colorado mines, said:

The reduced cost of obtaining gold from ores or rock containing it is due:

"(1) To the numerous new deposits of gold opened within the last few years. Such deposits are, of course, more cheaply mined while operations are conducted near the surface. In this country the increased activity in gold mining is doubtless due largely to the discouragement of silver mining by the fall in the price of silver. A large army of prospectors, formerly seeking for silver mines in preference to gold, is now looking for gold. But the most important new developments in gold are those in South Africa, where the deposits (though they have been overestimated in the speculations of the London stock market) are unquestionably of immense value and productive capacity.

"(2) To the increased efficiency of mining methods and machinery (high explosives, power drills, improved hoists and pumps, cable tramways, etc.), which permits large quantities of low grade material to be handled at a profit.

"(3) To the cheapening of labor and supplies by the extension of railroads, the increase of population, etc.

"(4) To the multiplication (especially in this country) of smelting and other reduction works, which can utilize other ingredients in gold-bearing rock (lead or copper directly, and iron or silica as fluxes), so as to be able to pay to the miner, in some cases, the full value of the gold.

"(5) The only innovation in metallurgical methods for the extraction of gold, apart from variations in smelting processes, is the so called 'cyanide' process, which promises to treat cheaply certain classes of ores and 'tailings.' Its principal competitor is the chlorination process, which is very old, but has been much improved, and is now the most perfect of all methods for gold extraction from material suitable to it. This process usually requires a preliminary 'roasting;' and it is claimed that the 'cyanide' process can be successfully operated without that preliminary. Probably the ultimate verdict of practice will be that each process has its special field, and that the choice between them will depend upon a careful consideration of all the elements of the special case—nature of material, cost of chemicals and skilled labor, expense of plant, etc. At the most successful of the Southern gold mines, the Haile mine in South Carolina, a profit is secured from material containing as mined about $4 per ton. This is first crushed and amalgamated in a stamp mill, and then the sulphide ores, unaffected by amalgamation, are saved by mechanical concentration, to be roasted, chlorinated, and leached.

"Rock yielding free gold to the extent of $3 per ton can be mined and amalgamated with profit under favorable conditions as to size and accessibility of deposit, cost of power, wages, etc., provided the operation is on a large scale."—The Evening Post.

Important to Millers.

The United States Circuit Court, Eastern District of Pennsylvania, in the case of Henry B. Keiper and Lanious B. Keiper, complainants, vs. Charles Miller, defendant, holds that the patent granted to Samuel M. Brua, November 12, 1878, No. 209,795, is valid and the defendant has infringed as alleged.

The Brua case dates from September, 1892, when Samuel M. Brua assigned to Messrs. H. B. & L. B. Keiper, of Lancaster, Pa., his patent No. 209,795, of November 12, 1878, for a "Process in Milling an Improved Grade of Flour," the claim of the patent reading as follows:

"The process of producing an improved grade of flour, consisting essentially in continuously mingling the corresponding grades of the valuable products of the first and after grindings, respectively, for running off the finished flour uniformly pending the regrinding and rebolting, substantially in the manner and for the purpose verified."

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THE MOTOCYCLE RACE.

The motocycle race for prizes aggregating $5,000, which were offered by the Chicago Times-Herald, and which was to have occurred November 2, was postponed until November 28, Thanksgiving day, at the request of eighteen makers, who had not been able to put their machines in readiness.

In the recent Paris-Bordeaux race it was necessary to postpone the race from its original date, and the contestants had seven months in which to get ready; the same was true in the Paris-Rouen contest; so it is not surprising that American inventors, who only had three months in which to perfect their carriages, should be somewhat behind-hand.

It was decided, however, to have a run over the course on Nov. 2, for a purse of $500, to be divided between those who covered the entire route to Waukegan and back, 92 miles, within the time limit of thirteen hours, but owing to an accident to the Duryea machine the Benz wagon had no rivals, and the judges awarded the prize to H. M. Mueller, of Decatur, Ill. Two carriages only entered the contest—the Benz motocycle, owned by H. Mueller, and the Duryea carriage, made by the Duryea Company, of Springfield, Mass. Crowds began to form along the Midway Plaisance as early as seven o'clock, and at 8:15 the two carriages started. The crowd was then so dense that the police had some difficulty in forcing the people back so as to make room for the motocycles. The two Kane Pennington motocycles arrived five minutes later and were sent across the line. Mr. Pennington announced that he did not care to compete in the special contest, but would make a run over the boulevard and across to Lincoln Park. Both the Duryea and the Benz vehicle had slight accidents before the outskirts of Chicago were reached. All Waukegan turned out to view the novel spectacle. The Benz wagon entered Waukegan at 2:40 P. M.; the motor was there replenished with gasoline and ice was dumped into the box above the motor to cool it, and in seven and one-half minutes the wagon was ready for the home stretch.

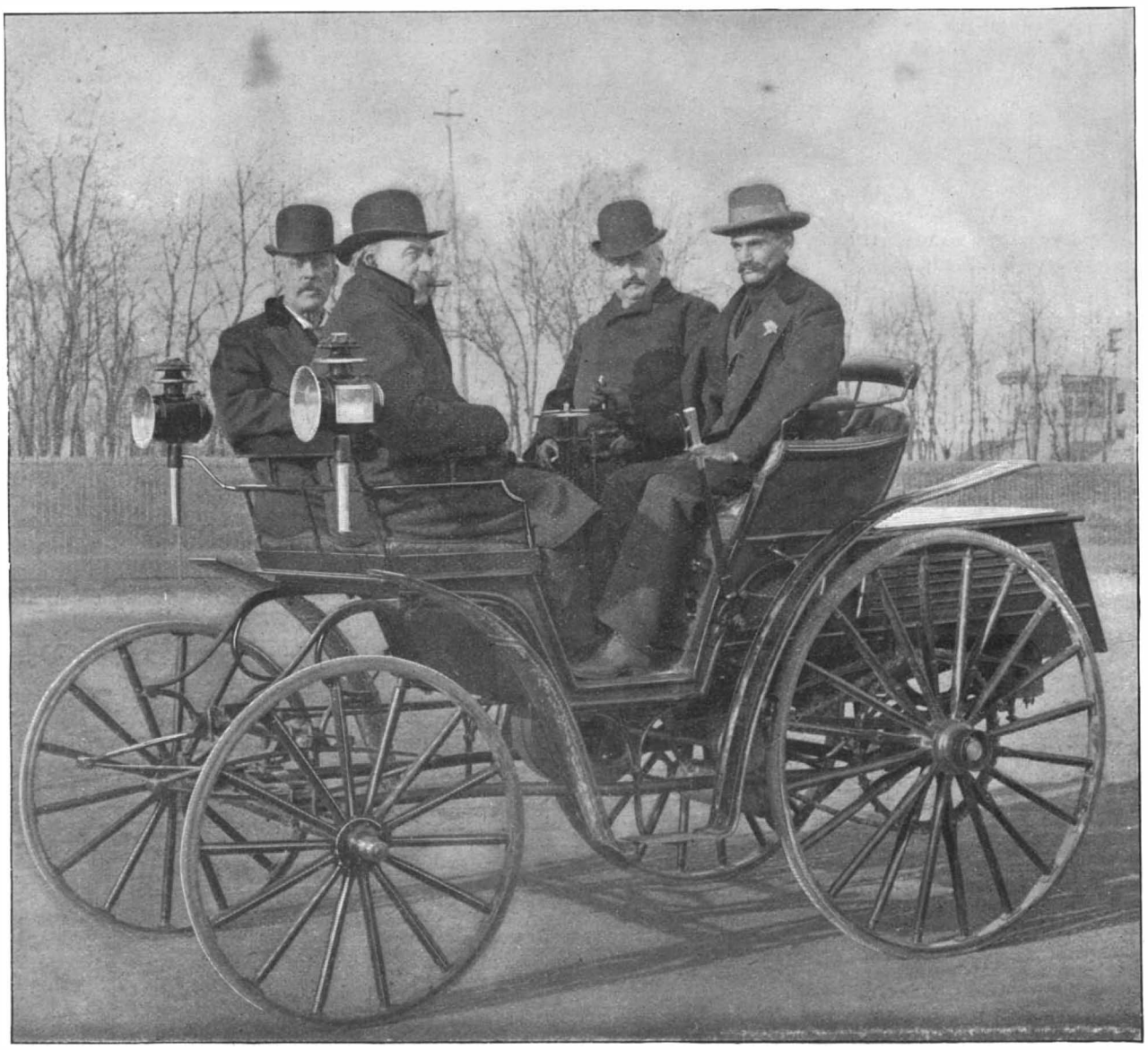
At Prairie View, one mile from Half Day, the Duryea wagon was going at a good rate along a narrow road; a little ahead of it a farmer was driving his team. In response to the whistle of the Duryea carriage the farmer determined to give up his right of way; he made a mistake, however, and turned his wagon to the left instead of to the right. The motor wagon ran to the left at the same time that the farmer swung around his horses. Mr. C. E. Duryea grasped the situation at once, and rather than have a collision he preferred to take chances with his machine, which was run down into a ditch at the side of the road. The motor wagon was disabled and out of the race, and Mr. Duryea had it hauled to the nearest railway depot and transported to Chicago. A large crowd was waiting to see the Benz carriage finish. At precisely 6:43 P. M. it stopped in front of the Grant monument and Judge Somers called out the official time of the finish. The judges then examined the motor carefully, and received a statement from Mr. Mueller of the delays he had experienced. The official statement of the judges is as follows:

The number of miles actually run was ninety-two. The gross time taken by the Benz motor in traveling this distance was 9 hours and 30 minutes. The start was at 9:13 yesterday morning and the finish at 6:43 in the evening. In making the run the only time delay allowed by the judges under the rules and conditions of the race was for stops at grade railroad crossings, where trains might temporarily block the way. The Benz machine lost seven minutes through this cause. The judges therefore corrected the running time from 9 hours and 30 minutes to 9 hours and 22½ minutes. This will be the official record of the length of time occupied, showing an average speed of approximately 10 miles an hour.

But the machine lost other time than that at grade crossings. Its total loss of time was forty-six minutes, making its real running time for the entire distance 8 hours and 44 minutes. The time losses enumerated were: By sparking machine, 2; by loss of tire, 7; adjusting tire second time, 3:30; by sparking machine, 2:30; taking water, 4; by sparking machine, 3:30; lost road by fault of bicycle guides, 4; taking supplies at Winnetka, 5; taking supplies at Waukegan, 7; loss at grade crossings, 7:30; total, 46.

The total consumption of gasoline for the ninety-two miles was 5⅛ gallons, representing an expense of less than $1. The result of this preliminary contest shows that a great interest will be taken in the race on Thanksgiving day.

MORRIS AND SALOM'S ELECTROBAT.



THE BENZ MOTOCYCLE.

We present an engraving of Mr. Mueller's Benz motocycle, which won in this preliminary race. The wagon was made under the Benz patent, and was imported from Mannheim, Germany, in May, and has since been in constant use. The motor is built on the same plan as all the Benz motors. The principle is that of the gas engine; crude gasoline is used, and the gas generated from it is exploded by an electric spark. It carries four passengers and is controlled by a person sitting on the rear seat. In Germany, the Benz motor wagon is very popular, and not long ago Emperor William, of Germany, rode on one from Maxau to Lauterberg, a distance of fifteen miles, in 35 minutes, an average speed of 2 minutes and 20 seconds per mile. Director William Esswein, of the Bavarian railroads, owns two of the Benz wagons, one with a top and one without, so as to be prepared for all kinds of weather, and travels in them 60 miles a day, going to business from his house at Durkheim, 15 miles from Ludwigshafen, and returning for his lunch. He makes an average speed of 2 minutes and 40 seconds per mile, and has been doing this almost daily for eighteen months.

We also illustrate the "Electrobat," which Morris and Salom, of Philadelphia, who are representing an electric storage battery company, have entered for the great race. They have coined the new word "electrobat" to describe their machines and give them a distinctive name. The termination, "bat," is derived from the Greek word "bainein," "to go." In the large "electrobat" which we illustrate, for they have entered two carriages, no machinery of any kind is in sight with the exception of the steering lever; the carriage seats two, but is arranged to have another seat on the back. There are two Lundell motors of nominal 1½ horse power each, attached to the front axle, and pinioned on the armature shafts, geared directly into the driving gears attached to the front wheel; the steering is accomplished by turning the rear wheels parallel with each other from a point about three inches inside of the plane of the wheel and connected by a rod to a vertical lever of a convenient height to be operated from the front seat of the carriage. It can be turned completely around in a circle of twenty feet in diameter; the wheels are of wood and are fitted with pneumatic tires and ball bearings.

The front wheels are 40 inches in diameter and the rear or steering wheel is 28 inches in diameter. The batteries are furnished by the Electric Storage Battery Company, of Philadelphia, and consist of four sets of twelve cells, each having a normal capacity of fifty ampere hours per cell. The controller is operated by means of a small hand wheel. There are four speeds ahead and one backward, which are obtained by various groupings of the batteries and motors in series and parallel. It is said that the carriage has a maximum speed

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of twenty miles an hour on good roads, and the capacity of the battery is sufficient to run the carriage for twenty-five miles. It weight complete with battery is 1,650 pounds.

Remarkable evidence of the widespread and growing interest which is felt in the development of automobile conveyances was afforded at the exhibition of horseless carriages by Sir David Salomons, at Tunbridge Wells, England, on October 15. The exhibition brought interested spectators from London and all parts of the country. The number of vehicles shown was not large, but was fairly representative; with one exception all of the carriages were of French manufacture and design.

Maple Sugar.

In the last issue of the Experiment Station Record, Vol. 7, No. 2, some interesting data are given concerning maple sugar and sirup, which were taken from the New Hampshire Experiment Station Bulletin No. 25. Messrs. A. H. Wood and F. W. Morse reported their conclusions based upon the analyses of twenty-six samples of maple sirup and of nineteen samples of maple sugar. Their conclusions are given as follows:

Experiments in letting sap stand for several days before boiling, filtering sap, and rapid and slow evaporation had no decisive effect on the composition of the sirup.

The sirups from soft maples were somewhat inferior to those of rock maples both in color and flavor.

Boiling the sap did not seem to affect the color of the sirup, but injured its flavor. Sap that was kept five days and then boiled gave one of the lightest colored samples produced.

The rapidity of boiling had little influence on the color, samples of sirup from saps that we allowed to slowly simmer away being as light colored as those from similar saps boiled rapidly.

The lightest colored samples were produced by boiling a quantity of sap until finished, without addition of fresh sap. One sample produced by boiling two quarts of sap in a large glass beaker until it was thick sirup, without addition of sap and without skimming, had little more color than the sap from which it had been made. This sap was from covered buckets, and was thoroughly strained through cloth before boiling.

Sap filtered through quartz sand produced a sirup in no way superior to the preceding, while one filtered through boneblack lost almost entirely the characteristic maple flavor.

Sap mixed with rain water gave a sirup objectionably dark colored.

Dark sugars contained less saccharose and more reducing sugars than light sugars, and had a much lower purity coefficient.

Photography as a Cure for Drunkenness.

We commend this story to the attention of our temperance contemporaries, "merely adding," as Mr. Richard Swiveller would say, that "if it isn't true, it's very good": "A woman in Salemville, Pa., determined that her husband should know how he looked when he was drunk. She knew how he looked well enough, and needed not that any man should tell her. Her children also knew by sad experience, but the man himself had a very imperfect idea of the state of his case. So once, when he came home and fell into a maudlin slumber, she sent for a photographer to come forthwith, and on his arrival she set before him his work. She ordered the photographer to photograph her husband as he sat in the chair. The photographer did his work, and did it well; and when the photograph was finished and laid beside the husband's place at breakfast it was a revelation, and the sobered gentleman experienced a decidedly new sensation. There was no need of explanation; the thing explained itself. There was no chance for contradiction; the sun tells no lies. There was no room for argument; a reform has taken place."

Navy Estimates—Captain Sampson's Report.

The annual report of Captain W. T. Sampson, chief of the Naval Bureau of Ordnance, contains an estimate of $6,457,984 for carrying out the plans of the bureau for the fiscal year ending June 30, 1897. Included in this amount are items of $25,000 for arming and equipping the naval militia, $500,000 toward the armament of auxiliary cruisers, and $4,390,204 toward the armament of vessels authorized.

He says: "The wisdom of the department's decision in favor of 13 inch caliber for the new battle ship has been conclusively demonstrated by recent armor tests."

The California Powder Company has succeeded in manufacturing excellent powder for the 8 inch as well as for the 5 inch guns, and is now in a position to make prismatic powder for all calibers.

Relating to the adoption of the Lee rifle as the naval small arm, Captain Sampson says: "The change in the navy caliber from 0·45 to 0·236 will result in a lighter gun, less shock of recoil, almost double muzzle velocity and danger space, more than double penetration, and a more than double quantity of ammunition carried on the person. These are actual results."

Cements in Mason Work.

A representative of the Brickbuilder, in an interview with Mr. William Peck, of the H. Wales Lines Company, Meriden, Conn., an authority on mason construction, obtained the following information:

"Do you favor the first or second setting of cements for mason work?" asked the interviewer.

"That depends," answered Mr. Peck, "upon the work I have in hand. Generally, however, I prefer the second setting. The truth is that masons very seldom use the first or even second setting of cement, but, owing to their ignorance of the action of cement, generally use it in its third setting. Laborers usually mix up a bed full at a time and temper it as it is used, sometimes once, very often twice; thus by the time it gets into the wall it is in its second or third setting.

"For sidewalks or cement floors I prefer the first setting, as it works better and does not become so spongy under the trowel."

"What do you consider the best mode of putting down cement floors?"

"I think the best manner to do a good job is, first, to have the ground underneath well tamped down and solid; second, to use screens instead of strips to get the proper thickness of cement; third, to have help enough to keep putting down all the time and not have to wait between batches, thereby causing a break or joint between the settings, which is liable to make a crack; fourth, to float the first coat or layer as little as possible, thereby preventing the rising of the sand to the top of the cement, and insuring a good bond between the rough coat and finish."

"What is one of the common errors of contractors?"

"One great mistake they make is in not keeping their walls properly covered during construction, especially in the winter. A few dollars expended for tar paper or canvas and the time required to cover them will often prevent hundreds of dollars' worth of damage by elements, and will not leave a dark streak there when construction is continued."

New Method of Refrigeration.

Considerable advances have taken place in the last few years of the processes adopted for artificially producing low temperatures, and, as the reports of the various experiments made by Professor Dewar at the Royal Institution have shown, degrees of cold can now be obtained with a facility which a few years ago would have been thought impossible, and such permanent gases as oxygen, nitrogen and hydrogen are liquefied without difficulty. Hitherto the necessary reduction of temperature to the critical point of such a gas, or rather a mixture of gases, such as is contained in the atmosphere, has been effected by the successive employment of liquefied gases boiling at lower and lower points on the scale, the latent heat of evaporation being employed as the medium for abstracting heat from the gas experimented upon, the final decrement of heat being obtained by the rapid evaporation of the liquid product itself. The precise modus operandi has been described at various times in our columns.

By a new process, however, the laboratory methods that have so far been employed for the liquefaction of gases having a very low boiling point appear likely to be supplemented, at all events, in producing such products on a commercial scale. The process, which is the invention of Herr Linde, a man of experience in refrigerating machinery methods, has been described in a recent issue of the London Times.

The new apparatus dispenses with the use of intermediate cooling agents, and relies entirely upon initial compression by powerful engines and subsequent partial expansion of the compressed air under carefully regulated conditions.

Most people probably have seen at one time or another the familiar lecture room experiment of forcing a piston suddenly down a cylinder, and showing the ignition of a scrap of touch paper by the heat thus produced. If while the compression is maintained the cylinder and its contained air be cooled to the original temperature, then, on suddenly withdrawing the piston and allowing the air to regain its original volume, there will be a fall of temperature corresponding to the rise on compression.

If now the cooled air could be used to reduce the temperature of a second quantity of air before expansion, it is evident that, starting from a lower point than the first batch, the second would on expansion reach a lower point.

This is the principle of the new liquid air apparatus. A powerful engine compresses air, which is cooled as far as possible by ordinary refrigerating methods, and passed into a spirally coiled pipe, over 100 yards long. This pipe is inclosed in a second spiral. By means of a valve at the end of the inner spiral a certain proportion of the compressed air is allowed to expand in the space between it and the outer pipe. Thus the stream of air flowing to and also from the pump is cooled by the compressed portion which has been allowed to expand, and arrives in its turn at the valve in a colder state than the portion that preceded it. Consequently it reaches a still lower temperature on expansion, cooling yet more powerfully the advancing stream in the inner tube.

By carrying this cumulative cooling effect sufficiently far the circulating air is at last brought down to its critical point, and liquefies, after which a continuous stream of liquid air is merely a question of engine power. It is impossible without the aid of diagrams to explain clearly how the continuity of the process is maintained, but the cycle of operations can be readily apprehended. There is compression, expansion in a closed chamber and utilization of the cold thus produced to repeat the cycle from a lower initial temperature.

During the process just described the air becomes steadily richer in oxygen until that gas forms some 70 per cent of the product. This relatively pure oxygen is sufficiently good for certain purposes, and it may be further purified from nitrogen if desired. The price of oxygen gas thus obtained compares, it is said, favorably with that produced by the methods now in use. It would have been gratifying (the Times remarks) to have been able to announce that this commercial application of recent scientific ideas, so closely associated with the Royal Institution, had been made in England. But, unfortunately, in this, as in so many other cases, it has been "made in Germany," where there is at present far more alertness and a far higher standard of technical knowledge than among ourselves.

Wood Pulp Fruit Cans.

Wood pulp fruit cans are among the latest applications of wood fiber to a useful purpose.

The preparatory machinery, the American Wood Worker tells us, consists of a beating engine, for disintegrating the pulp, and a compressed air pump and an engine for pumping the fluid pulp. The soft pulp produced is placed on the fine netting and the moisture driven out by compressed air, the mesh holding the fiber permitting the water to escape. The pulp, while yet in a soft state, is gathered upon a large roller in sheets about 8×10 feet square, until about a quarter of an inch thick. It is then cut off the roller and carried up on a canvas carrier to a drying chamber nearly 100 feet long, through which it slowly passes, requiring about ten minutes to make the trip. When the sheet arrives at the other end it is partly dry and may be handled readily. It is placed next between pressing rollers, then shaped into cans about as ordinary tin ones are, the edges being connected with a special glutinous matter. Then the cans are finished off in the machine. This is one way, but it makes a seam. Another mode, adopted later, in which no seam on the side is made, consists in taking the soft pulp direct from the wire netting and moulding it into cylindrical form, about the length of a dozen cans, and keeping it on the hollow tubes until ready for cutting and heading.

A New Star in Carina.

Dr. Edward C. Pickering announces in Harvard College Observatory Circular, No. 1, that from an examination of the Draper Memorial photographs taken at the Arequipa Station of the Observatory, Mrs. Fleming has discovered that a new star appeared in the constellation Carina in the spring of 1895. On sixty-two plates, the first taken on May 17, 1889, and the last on March 5, 1895, no trace of the star is visible, although on some of them stars as faint as the fourteenth magnitude are clearly seen. The exposures of these plates varied from 10 to 242 minutes. On nine plates, the first taken on April 8 and the last on July 1, 1895, the star appears and its photographic brightness diminishes during that time from the eighth to the eleventh magnitude. This star precedes A. G. C. 15269 (photometric magnitude 5·47) 0·5m., and is 0″·7 north. Its approximate position for 1900 is therefore in R. A. 11h. 3·9 m., Dec. —61° 24′. Two stars of the eleventh magnitude are near the Nova. One is nearly north, 110″ distant, the other is 80″ south preceding.

Sealing Bottles Electrically.

In a recent number of La Nature, M. A. M. Villon describes a novel method of sealing champagne bottles. The loss and deterioration of champagne due to the escape of gas has long, he says, made some process of perfect airtight sealing desirable. M. Villon accomplishes this by covering the cork and part of the neck with a thin layer of copper electrically deposited. For this purpose the neck of the bottle is coated with a conducting substance such as blacklead, zinc or copper powder, and plunged in a galvanic bath. This bath has a cover of paraffined wood with conical holes, which are lined with copper rings. All these rings are connected among themselves, and with the negative pole of the dynamo, while a copper sheet in the bath is connected to the positive pole. The bottles are simply inserted in the holes, neck down, and when a layer of two-tenths to three-tenths of a millimeter has been deposited the current is stopped. The deposit may be gilt or silvered, or given any desired shade in special baths. The process, of course, can be employed to seal bottles for mineral waters, preserves, and a variety of products.

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RECENTLY PATENTED INVENTIONS.

Engineering.

HYDRAULIC AIR BLAST APPARATUS.—Henry A. and Isaac Rogers, Bingham Canon, Utah. For furnishing air at a comparatively low cost to buildings, forges, mines, etc., and removing foul air therefrom, these inventors have devised an apparatus comprising a straight hollow cylinder open at one end and contracted at the opposite end, an air pipe being connected to the contracted end, and a water nozzle projecting into the cylinder, in the bottom of which, near the contracted portion, is a trapped outlet pipe. The water nozzle has an outwardly leading branch, the outward discharge of water withdrawing air.

GRAVITY ENGINE.—Thomas G. Blatch, Hazleton, Pa. Upon a shaft is held to turn a hub or sleeve having opposite radial cylinders, there being stuffing boxes in the ends of the sleeve and the outer ends of the cylinders, whose inner ends are connected by ports with inlet and exhaust openings in the shaft. Plungers sliding in the cylinders are rigidly connected at their outer ends with a heavy wheel, and the motive agent, entering through a port in the shaft, pushes the piston in one cylinder to lift the wheel, the other port being then connected with the exhaust opening, and the wheel being rotated by its own gravity, as the different ports are thus alternately opened and closed.

Railway Appliances.

CABLE GRIP.—Zebulon S. Taylor, Long Branch, N. J. This improvement enables the gripman to readily open and close the gripping jaws to release or engage the cable, and is so arranged that a part of it automatically releases the cable at a crossing and swings clear of the crossing cable, while the remaining part of the grip retains its hold on the cable grip until the first part has again closed on the cable, to be then moved up and clear of the crossing cable. The device comprises hinged casings in which are hinged gripping jaws adapted to be opened and closed in the closed casings, the jaws having arms with which are connected crossheads carried on piston rods moving in cylinders connected with a compressed air supply. A further patent has been allowed the same inventor for improvements enabling the gripman to stop or start the car on curves in the road without danger of losing the cable or permanently displacing it from its supporting pulleys in the duct.

Electrical.

CLOSED CONDUIT RAILWAY.—Michael F. Flynn, Stamford, Conn. In this conduit are supply and return wires and a contact rail with which a trolley mounted on the car is arranged to run, while switch devices at intervals along the conduit are adapted to connect with the supply and return wires, the car carrying mechanism for operating the switch devices, and also a shifting device to shift the switch devices to a neutral position. The switches are worked automatically and positively, although adapted to yield without breaking under excessive strain, and the conduit may be easily and inexpensively laid and its contained wires perfectly insulated.

Mining, Etc.

DUMPING APPARATUS.—John D. Kelly, John Watson and William J. Brown, Coal City, Ill. This is an improvement especially adapted for mine cages, etc., and provides for a dumping platform in connection with a cage, on which a loaded car may be locked so that it will not move as the car is drawn upward or lowered. When the cage has reached a specified point in the shaft, the platform with its car may be automatically dumped to the right or left, or it may be dumped in either direction by hand without the operator entering the shaft.

SEPARATOR.—William O. Lentz, Mauch Chunk, Pa. This invention relates to jigs for separating coal from slate, ore, and other material, and the separator comprises a pan having an overflow at one end, where there is a well with inclined bottom and a gate at its lower end, while a shield at the lower edge of the side of the pan extends inwardly and downwardly into the well. The coal passes over the overflow and the slate passes down the well and into a separate compartment.

Mechanical.

CHUCK.—Thomas E. Cherry, Bath, Me. This chuck comprises a body having a central sleeve with external guide grooves, there being sliding jaws on the chuck body, levers on the back of the chuck to operate the jaws, wedges in the guide grooves to engage the levers, and a screw collar to actuate the wedges. The chuck may be applied to an ordinary lathe spindle, and the jaws may be very quickly adjusted and firmly fastened, the jaws and mechanism being so arranged that face plate work, such as sheaves, bushings, gears, etc., may be very advantageously held.

WRENCH.—Clarkson B. Collins, Miller's Ferry, Ala. This is a tool which may be quickly and very finely adjusted, and in which the movable jaw may be locked in whatever position it may be placed with reference to the fixed jaw. A sleeve has free movement on the body of a toothed shank, spring-controlled dogs carried by the sleeve engaging the teeth, while a slide operates on the dogs. The tool is of very simple and durable construction.

SCREW CUTTING LATHE.—Wendell P. Norton, Torrington, Conn. This is an improvement upon former patented inventions of the same inventor, providing improvements whereby the movement of the carriage is automatically arrested. The reversing rod is under the control of the operator, and an auxiliary slidable rod having adjustable stop collars is adapted to be alternately engaged by the carriage, a lever being connected with the reversing rod and the auxiliary rod, while a clutch mechanism actuated by the lever is adapted to be alternately connected by oppositely driven reversing gears with the driving shaft.

GRINDING MACHINE ATTACHMENT.—Amos Hartley, Vassar, Kan. According to this improvement a U-shaped frame is adapted to be supported on the work-holding mandrel of the grinding machine, the frame having in the ends of its arms means for securing in axial alignment a form or pattern and an irregular piece of work to be ground, the pattern being in position to be engaged by a finger or projection on the tool post while the work is engaged by the grinding wheel on the spindle of the tool rest.

Miscellaneous.

EVAPORATOR.—Peter Cooper Hewitt, New York City. This apparatus has heating tubes and one or more return tubes, and a separating chamber with a series of stationary tangential nozzles communicating with the heating tubes, to effect the separation of the vapor and the concentrated liquid by the motion of the liquid. The separating chamber has a vapor outlet, and one or more liquor outlets at its bottom while a liquor overflow is arranged between lines passing through the vapor outlet and return liquor outlet, to maintain the inner or free surface of the body of liquor between the vapor outlet and the return liquor outlet. The method and apparatus may also be used for separating a mixed liquid or solution by the removal of one portion in the form of vapor, leaving another portion which is not vaporized.

CARBONATOR.—George Noll, Minden, Germany. According to this improvement an upright cylinder is filled with small pieces of glass, porcelain, etc., not soluble in water or carbonic acid, and carbonic acid gas is delivered through a pipe to the bottom of the vessel, the upward flow of the gas meeting a downward flow of finely divided water supplied at the top, the gas coming in contact with all the particles of water, forming a perfectly uniform product free from air, and the charged product passing through perforated partitions into an accumulator at the bottom.

BICYCLE DRIVING GEAR.—Carl Nordell, Stamford, Conn. This gear dispenses with the chain and sprocket wheel, substituting therefor vertically swinging pedal levers which drive directly the rear wheel, there being a shifting fulcrum for the levers, whereby they revolve the wheels with which they are connected by a comparatively small foot movement. On the bicycle frame, on opposite sides of the rear wheel, are journaled gear wheels having inwardly projecting rims, pedal levers having a crank connection with the gear wheels, while hangers adjustably pivoted on the frame are slidably connected with the pedal levers, pinions connected with the rear wheel being geared to the inner sides of the gear wheel rims.

PHOTOGRAPHIC RETOUCHER.—John N. Choate, Carlisle, Pa. Two patents have been granted this inventor for two forms of an apparatus in which the retouching pencil or stylus is held rigid or immovable while in use, and every movement of the body of the instrument is due to vibration of the armature, which has an elastic or yielding contact with the body or frame of the instrument to vary the power of the stroke. The adjustment of the pencil or stylus at different angles to the body of the instrument is also provided for, and for holding it fixed in different adjustments. The retouching pencil may also be secured to the frame of the handpiece or motor to form an immovable part of the instrument while in use, a tremulous movement being imparted to the motor and the hand in which it is held, whereby the pencil point is caused to make rapid but slight impacts on the negative, producing the most delicate retouching effect.

HOISTING APPARATUS.—Lincoln Frederic, Shamokin, Pa. This improvement relates especially to improved construction of guides upon the car and frame, whereby the dumping operation is accomplished in an easy manner, and the return of the car to and its stoppage in normal hoisting position are assured. The improvement may be applied to a bucket car for hoisting water from drowned wells.

APPARATUS FOR LIFTING FISHING NETS OR LINES.—Ralph and Walter M. Connable, Petoskey, Mich. According to this improvement an endless carrier has devices for gripping and carrying forward a net, and releasing it at the delivery end of the carrier, there being a number of the gripping jaws opened by the weight or strain of the nets sufficiently to receive the net or a portion of it, but not enough to admit the leads, floats, or fish. The machine stands preferably near the pilot house, so that the wheelman regulates the speed of the net-lifting device, and the nets are drawn from the water with a continuous and uniform inward movement.

FIRE EXTINGUISHER.—Mariner J. Kent, New York City. In portable apparatus where two chemicals are employed, this invention provides an improved holder for the acid, preventing its accidental escape and the entrance of the surrounding liquid without the use of a valve or stopper for the acid holder, but having novel conveniences for its proper gradual escape, so that the acid will fully combine with the second liquid, and the escape of uncombined acid from the apparatus will be prevented.

GOODS EXHIBITOR.—Gustav L. Heyman, Carlisle, Ky. For supporting and exhibiting bolts of oil cloth, each rolled on a central wooden stick, this invention provides a suitable stand mounted on casters, on which is a goods holder or carrier revoluble about a central post. The oil cloth bolt retains its rigid condition, and yet is rotatable on the supporting devices, the goods being kept neatly rolled, and so that the patterns may be readily displayed.

WINDOW.—Lorenzo A. Murphy and Alexander H. Milne, Wellington, Canada. This invention provides an improved sash-balancing device in connection with a novel draft-closing board, affording means to seal the window at its sill and permit the upper sash to be lowered slightly for ventilation. The invention is adapted for use on any window having two sashes slidable vertically in a casement, simple means being provided for utilizing the weight of one sash to counterbalance the other sash.

SASH BALANCE.—Joseph H. Bane, Barre, Mass. This is an improvement on a formerly patented invention of the same inventor, the operative portion of the balance being contained in a casing set in the window frame and the window sash having on each side a rack. The spindle on which the pinion revolves is capable of lateral movement, and is controlled by a spring brake and adjusting device, and before introducing the sash into the frame the pinions to engage the sash may be carried within their casing, leaving the sash groove free and uninterrupted.

SCAFFOLD BRACKET.—Aaron L. Wade, Bradford, Ohio. This is a bracket which may be applied to or supported by a ladder either from the front or from the back, and may be adjusted from rung to rung of the ladder, as required, and given any desired inclination. It may also be attached at one of its ends to a roof or equivalent support when necessary, and may be folded when not in use to occupy a small space.

BRACKET.—Charles A. Baker, Waukesha, Wis. This is a bracket more especially designed for use on vestibule doors, windows, etc. It consists of a tubular base with integral flanges for fastening the base in position on a door, window, or other support, while a telescoping bracket member has a head for supporting a rod or pole and a split tubular shank fitted to slide in the base is adapted to be secured thereto.

VEHICLE SPRING.—Willie N. Snow, Eaton, N. H. Combined with the bolsters and side bars are coiled springs having their ends extended outward and the axes of their coiled portions parallel with the side bars, one end of each spring being attached to a bolster and the other ends having pivotal connection with the side bars, while an equalizing frame journaled on the bolsters has outwardly extended arms pivotally connected to the side bars, the yokes or stirrups on the bolster embracing one arm of the equalizing frame and the adjacent end of the spring.

WAGON BRAKE.—Benjamin F. Jackson and Marshal L. Hughes, Sutton, West Va. This improvement comprises a brake beam with heavy shoes to engage the wheels, a spring throwing the beam into braking position, while a lever with swinging fulcrum is connected to the brake beam, and a draught mechanism connected to the lever is arranged to hold the brake shoes out of engagement with the wheels when a pull is exerted on the draught mechanism. The brake acts automatically when a vehicle is traveling down grade, or when the horses are not exerting a pulling strain.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

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4. A residence at Germantown, Philadelphia, recently erected at a cost of $25,000 complete, including stable. Perspective elevation and floor plans. Architects, Messrs. Hazlehurst & Huckel, Philadelphia, Pa. An ornate residence in the Spanish Renaissance style.
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7. A cottage at Mount Vernon, N. Y., recently erected at a cost of $2,500. Two perspective elevations and floor plans. Architect, Mr. A. M. Jenks, Mount Vernon, N. Y.
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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6657) F. E. T. asks how to transfer prints to wood. A. First varnish the wood once with white hard varnish, then cut off the margins of the print, which should be on unsized paper. Wet the back of it with a sponge and water, using enough water to saturate the paper, but not so as to be watery on the printed side. Then, with a flat camel's hair brush, give it a coat of transfer (alcohol) varnish on the printed side, and apply it immediately, varnished side downward, on the woodwork, placing a sheet of paper on it and pressing it down evenly with the hand till every part adheres. After standing a short time, gently rub away the back of the print with the fingers, till nothing but a thin pulp remains. It may require being wetted again, before all that will come (or rather ought to come) off is removed. Great care is required in this operation, that the design or printed side be not disturbed. When this is done and quite dry, give the work a coat of white hard varnish and it will appear as if printed on the wood.

(6658) C. A. M. asks how to clean cast iron, wrought iron, and steel preparatory to plating. A. Cleansing Cast Iron.—Castiron is freed from grease, etc., by dipping in hot alkali solution used for a similar purpose with copper, and after rinsing thoroughly is pickled in water containing about 1 per cent of sulphuric acid for several hours; then rinsed in water and scoured with fine sharp sand or pumice and a fiber brush. It is then rinsed and returned to the acid pickle for a short time, rinsed again and put into the plating bath directly. If more than one per cent of acid is used in the pickle, th time of immersion must be shortened, otherwise the iron will be deeply corroded, and the carbon which the metal contains, and which is not affected by the acid, will not yield without a great deal of labor to the sand and brush. Cast iron does not gild or silver well by direct deposit. Copper or bronze deposits are better, though not perfect; but if the iron is tinned, the coat is adherent and will readily receive the other metals. Cleansing Wrought Iron.—The cleansing of wrought iron, if much oxidized, is effected in the same manner as cast iron; but it will bear a stronger pickle and a longer exposure. Whitened, filed or polished iron may be treated like steel. Cleansing steel.—Dip in the caustic lye used for copper, etc., rinse thoroughly, scour with pumice powder moistened, rinse and pass through the following dip:

Water	1 gal.
Hydrochloric acid	.4 lb.

Rinse quickly (but thoroughly) and plunge in the bath. Clean wrought iron and steel gild well without an intermediary coating in hot electro gilding baths. It is difficult to obtain an adherent coating of silver on these metals without interposing an intermediate coating of copper or brass, which renders the further operation of silver plating easy.

(6659) C. P. H., Portland, asks: What effective working pressure would be had at the end of a line of one inch pipe two miles long, with a compressor supplying either 500 or 1,000 cubic feet of free air per minute at a pressure of five atmospheres or 75 pounds per square inch? A. With a delivery of 5½ cubic feet of free air per minute you will have a pressure of 60 pounds per square inch and for 12 cubic feet of free air per minute the pressure will drop to 10 pounds pressure at the point of delivery. For the distance stated the total volume of 500 cubic feet per minute will require a 10 inch pipe for a 70 pound working pressure at the end of the line.

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November 5, 1895,

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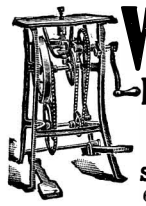

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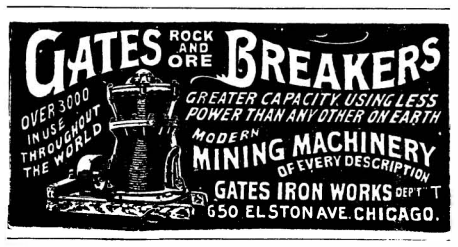
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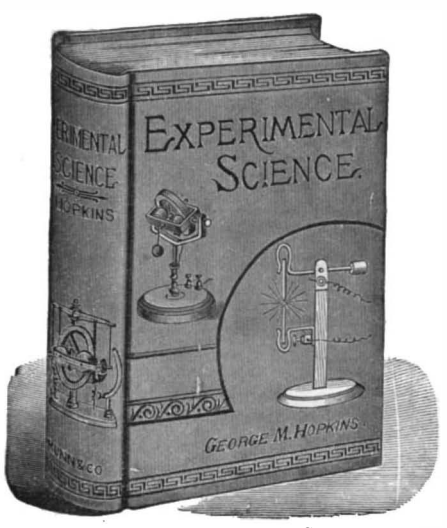

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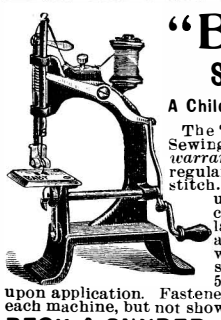

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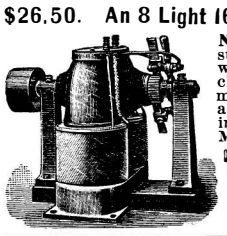

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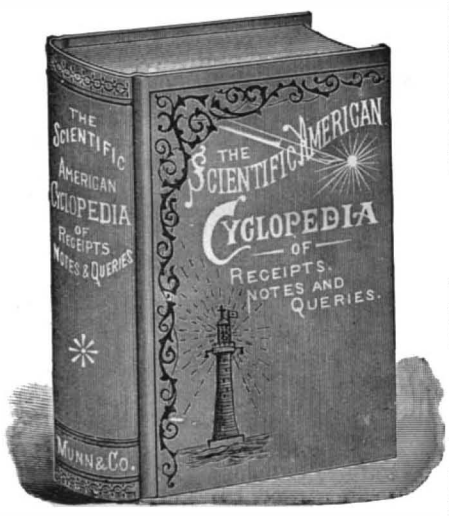

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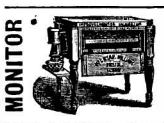

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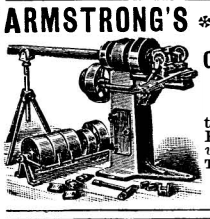

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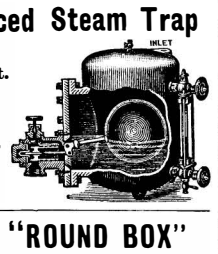

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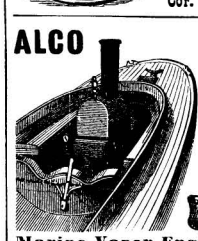

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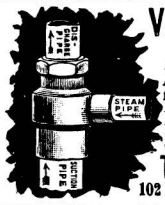

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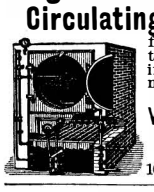

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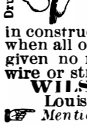

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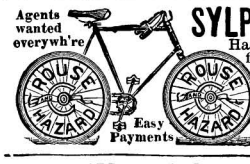

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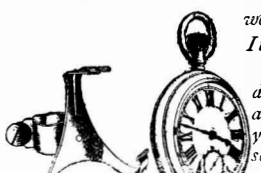

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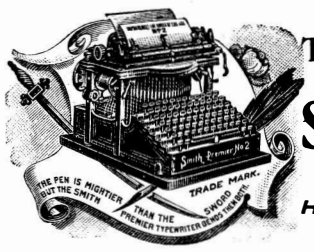

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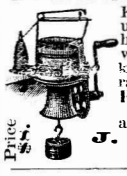

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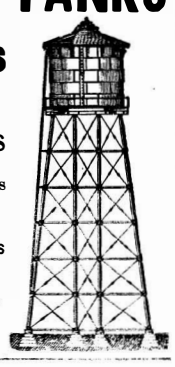

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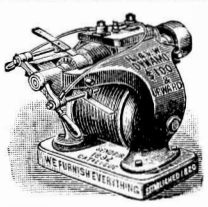

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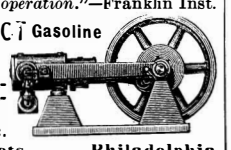

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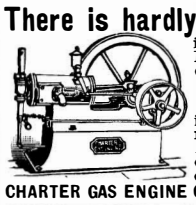

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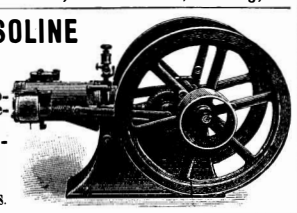

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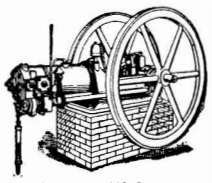

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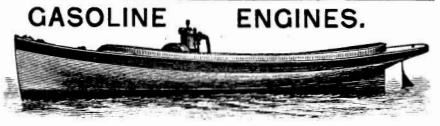

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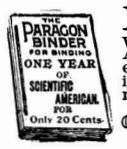

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